



Empowering Learners to Build Production - Ready
AI Agents

Applied Agentic AI for SWEs

Capstone Project : AI Finance Assistant

Democratizing Financial Literacy Through Intelligent
Conversational AI

Problem Statement

1. Business Use Case

Financial literacy remains a significant barrier for millions of potential investors, with complex terminology, overwhelming choices, and fear of making mistakes preventing many from building wealth through investing. The AI Finance Assistant addresses this gap by providing personalized, accessible financial education and guidance through an intelligent multi-agent conversational system.

The Business Opportunity:

- **Democratized Financial Access:** By providing clear, jargon-free explanations and personalized guidance, the assistant helps beginners overcome the intimidation factor of investing, potentially opening markets to millions of new participants.
- **Personalized Learning Paths:** The multi-agent system adapts to each user's knowledge level, goals, and risk tolerance, creating customized educational experiences that traditional one-size-fits-all resources cannot match.
- **Real-Time Market Integration:** By combining educational content with live market data, users can learn concepts while seeing real-world applications, bridging the gap between theory and practice.
- **Scalable Financial Guidance:** The AI system can serve thousands of users simultaneously, providing quality financial education at a scale impossible with human advisors alone.

The Power of Multi-Agent LLMs:

- **Specialized Expertise:** Each agent focuses on specific domains (portfolio analysis, market trends, tax education), ensuring deep, accurate responses in each area.
- **Context Preservation:** The system maintains conversation history and user profiles, enabling progressively sophisticated guidance as users learn.

- **RAG Enhancement:** Retrieval-augmented generation ensures responses are grounded in verified financial knowledge while remaining conversational.

Challenges and Considerations:

- **Regulatory Compliance:** The system must clearly distinguish between education and financial advice, including appropriate disclaimers.
- **Accuracy and Reliability:** Financial information must be accurate and up-to-date, with robust error handling for API failures.
- **User Trust:** Building confidence in AI-generated financial guidance requires transparency, citations, and conservative recommendations.

Conclusion:

The AI Finance Assistant represents a significant opportunity to democratize financial education, helping millions of beginners take their first steps toward financial security. By combining cutting-edge AI technology with sound financial principles, this system can transform how people learn about and engage with investing.

2. Technical Architecture

The AI Finance Assistant employs a sophisticated multi-agent architecture built on modern AI frameworks:

Core Components:

| Component | Technology | Purpose |
|--------------------|-----------------------------|---|
| Multi-Agent System | LangChain/LangGraph/Cre wAI | Orchestrates specialized agents for different financial domains |

| | | |
|-------------------------|---|---|
| Language Model | Google Gemini/Open AI GPT/Claude Sonnet | Powers natural language understanding and generation |
| Vector Database | FAISS/Chroma DB /Pinecone DB | Enables semantic search over financial knowledge base |
| Market Data | Alpha Vantage API /yFinance API | Provides real-time stock quotes and financial data |
| Web Interface | Streamlit/Gradio/React | Delivers interactive user experience |
| State Management | LangGraph/CrewAI | Maintains conversation context and user sessions |

Agent Architecture:

The system consists of six specialized agents:

1. **Finance Q&A Agent:** Handles general financial education queries
2. **Portfolio Analysis Agent:** Reviews and analyzes user portfolios
3. **Market Analysis Agent:** Provides real-time market insights
4. **Goal Planning Agent:** Assists with financial goal setting and planning
5. **News Synthesizer Agent:** Summarizes and contextualizes financial news
6. **Tax Education Agent:** Explains tax concepts and account types

Data Flow:

User Query → Workflow Router → Appropriate Agent(s) → RAG Retrieval → LLM Processing
→ Response Generation → User Interface

3. Deliverables/Objectives

1. **Develop a production-ready multi-agent financial assistant system:**
 - Implement all six specialized agents with distinct capabilities
 - Create robust workflow orchestration using LangGraph/CrewAI
 - Build comprehensive test suite with 80%+ coverage
 - Implement error handling and fallback mechanisms
2. **Create an intuitive user interface:**
 - Application with conversational interface
 - Portfolio analysis dashboard with visualizations
 - Market overview with real-time data
3. **Build a comprehensive knowledge base:**
 - Curate 50-100 financial education articles
 - Implement vector indexing for efficient retrieval
 - Create category-based filtering for targeted responses
 - Include source attribution for transparency
4. **Integrate real-time market data:**
 - Connect to Alpha Vantage/yFinance API for live quotes
 - Implement caching strategy for performance
 - Handle rate limits and API failures gracefully
 - Provide market trend analysis and insights
5. **[OPTIONAL] Implement MCP server for Claude Desktop integration:**
 - Expose finance tools via Model Context Protocol
 - Enable seamless integration with Claude Desktop
 - Document protocol implementation

4. Learning Goals

This project provides hands-on experience with cutting-edge AI technologies while addressing a real-world problem:

Technical Skills:

- Master multi-agent architectures using LangChain and LangGraph/CrewAI
- Implement RAG systems with vector databases
- Build production-ready AI applications with proper error handling
- Integrate external APIs and manage real-time data
- Create intuitive user interfaces for AI systems

Domain Knowledge:

- Understand basic financial concepts and investment principles
- Learn about portfolio management and diversification
- Grasp market dynamics and analysis techniques
- Appreciate regulatory and ethical considerations in fintech

Professional Skills:

- Design complex systems with multiple interacting components
- Write comprehensive documentation and tests
- Consider user experience in AI application design
- Balance technical sophistication with accessibility

This project simulates a real-world fintech startup scenario where you're building an MVP to democratize financial education. Consider scalability, user trust, and regulatory compliance throughout your implementation.

5. Submission Guidelines

Working Prototype:

- Fully functional AI Finance Assistant with all core features:
 - At least above mentioned working agents with specialized capabilities
 - Web interface for conversation
 - Portfolio analysis of user input
 - Real-time market data lookup
 - Ability to plan financial goals keeping risk appetite in mind
- A demo video (5-10 minutes) showcasing:
 - Multi-turn conversations with different agents
 - Portfolio analysis demonstration
 - Market data integration
 - Goal planning example

Sample Code and Architecture:

Well-organized codebase following the prescribed structure:

```
ai_finance_assistant/  
├── src/  
│   ├── agents/  
│   ├── core/  
│   ├── data/  
│   ├── rag/  
│   ├── web_app/  
│   ├── utils/  
│   └── workflow/  
└── tests/
```

|— config.yaml
|— requirements.txt
└— [README.md](#)

- [Optional] Comprehensive test suite with unit and integration tests
- [Optional] Configuration management via YAML/environment variables
- Proper error handling and logging throughout

Documentation:

- Detailed README with:
 - Architecture overview
 - Setup instructions
 - API documentation
 - Usage examples
 - Troubleshooting guide
- Technical design document covering:
 - System architecture decisions
 - Agent communication protocols
 - RAG implementation details
 - Performance considerations

Deployment Artifacts:

- Docker configuration (optional)
 - Environment setup files
 - Sample data for testing
 - Performance benchmarks
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6. Evaluation Criteria

Technical Implementation (40%)

- **Multi-Agent Architecture (10%):** Proper implementation of all agents with clean separation of concerns
- **LangGraph Workflow (10%):** Correct orchestration, state management, and routing
- **RAG Implementation (8%):** Effective knowledge base indexing and retrieval
- **Real-time Data Integration (7%):** Robust API integration with proper error handling
- **MCP Server (5%):** Bonus points for Claude Desktop integration

User Experience & Interface (25%)

- **Streamlit Application (10%):** Multi-tab interface with responsive design
- **Conversational Flow (8%):** Natural interactions with context preservation
- **Data Visualization (7%):** Clear, informative charts and displays

Financial Domain Knowledge (20%)

- **Educational Content (8%):** Comprehensive, accurate financial information
- **Portfolio Analysis (7%):** Meaningful metrics and recommendations
- **Market Intelligence (5%):** Relevant real-time insights

Code Quality & Documentation (15%)

- **Code Organization (5%):** Modular architecture with clean code
 - **Documentation (5%):** Comprehensive README and inline documentation
 - **Testing (5%):** Thorough test coverage with edge cases
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7. Future Directions

The AI Finance Assistant provides a foundation for numerous enhancements:

Advanced Features:

- **Voice Interface:** Natural speech interaction for accessibility
- **Mobile Application:** Native iOS/Android apps for on-the-go access
- **Advanced Analytics:** Monte Carlo simulations, risk modeling
- **Social Features:** Community learning, peer comparisons
- **Automated Investing:** Integration with brokerage APIs

Technical Enhancements:

- **Multi-Modal Input:** Chart analysis, document parsing
- **Personalization Engine:** ML-based recommendation system
- **Distributed Architecture:** Microservices for scalability
- **Real-time Collaboration:** Multi-user portfolio planning

Market Expansion:

- **International Markets:** Support for global exchanges
- **Cryptocurrency Integration:** Digital asset education and analysis
- **Small Business Tools:** Expand to business financial planning
- **Educational Partnerships:** Integration with finance courses

AI Advancements:

- **Fine-tuned Models:** Domain-specific LLM training
- **Behavioral Analysis:** Predict and address user biases
- **Explainable AI:** Transparent decision-making processes
- **Continuous Learning:** System improvement from user interactions