INVESTOR INTELLIGENCE AGENT

FOR ISY 5005 INTELLIGENT SOFTWARE AGENTS (ISA) PROJECT MODULE

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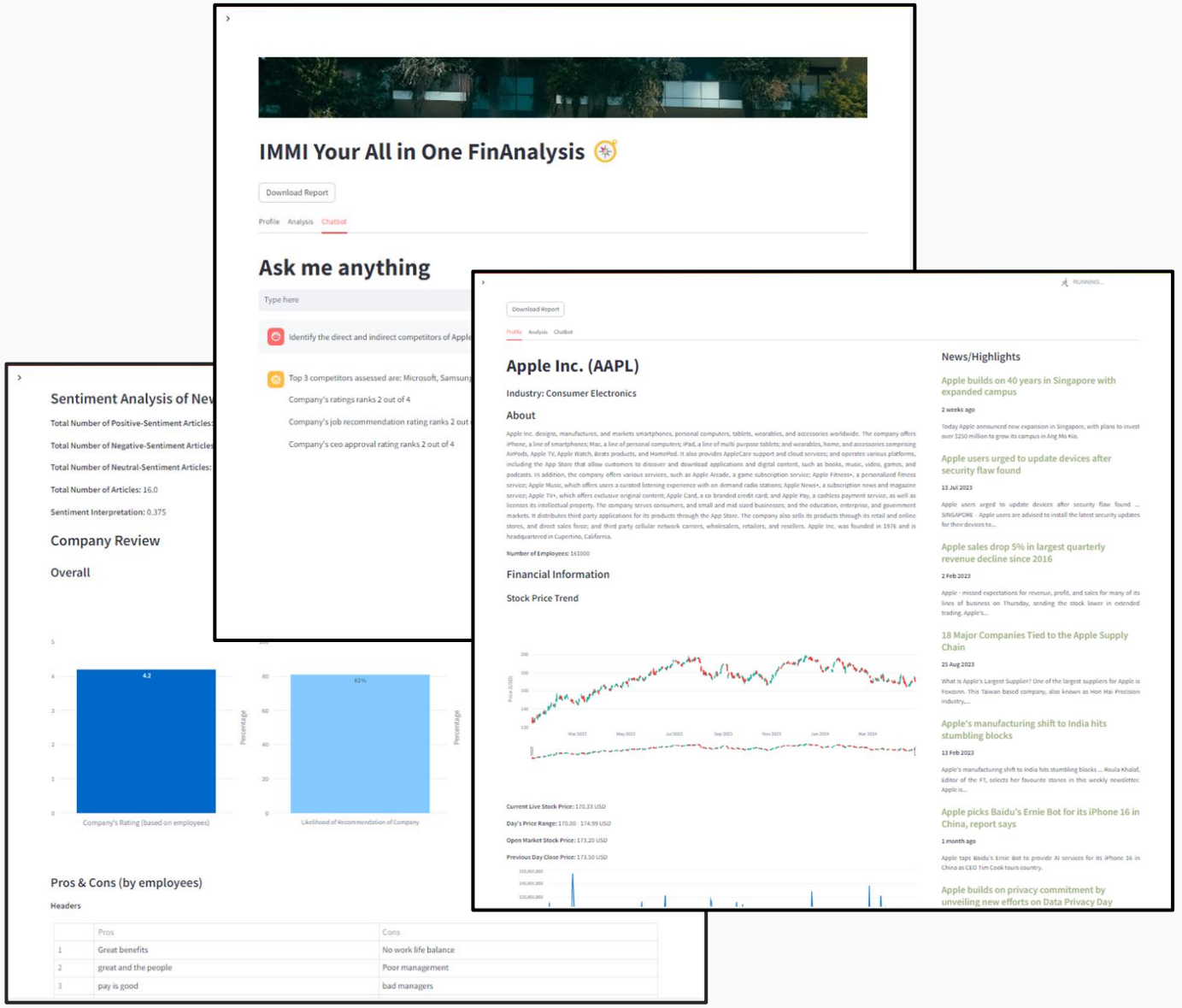
SYSTEM ARCHITECTURE OVERVIEW

1. **User-friendly Interface**

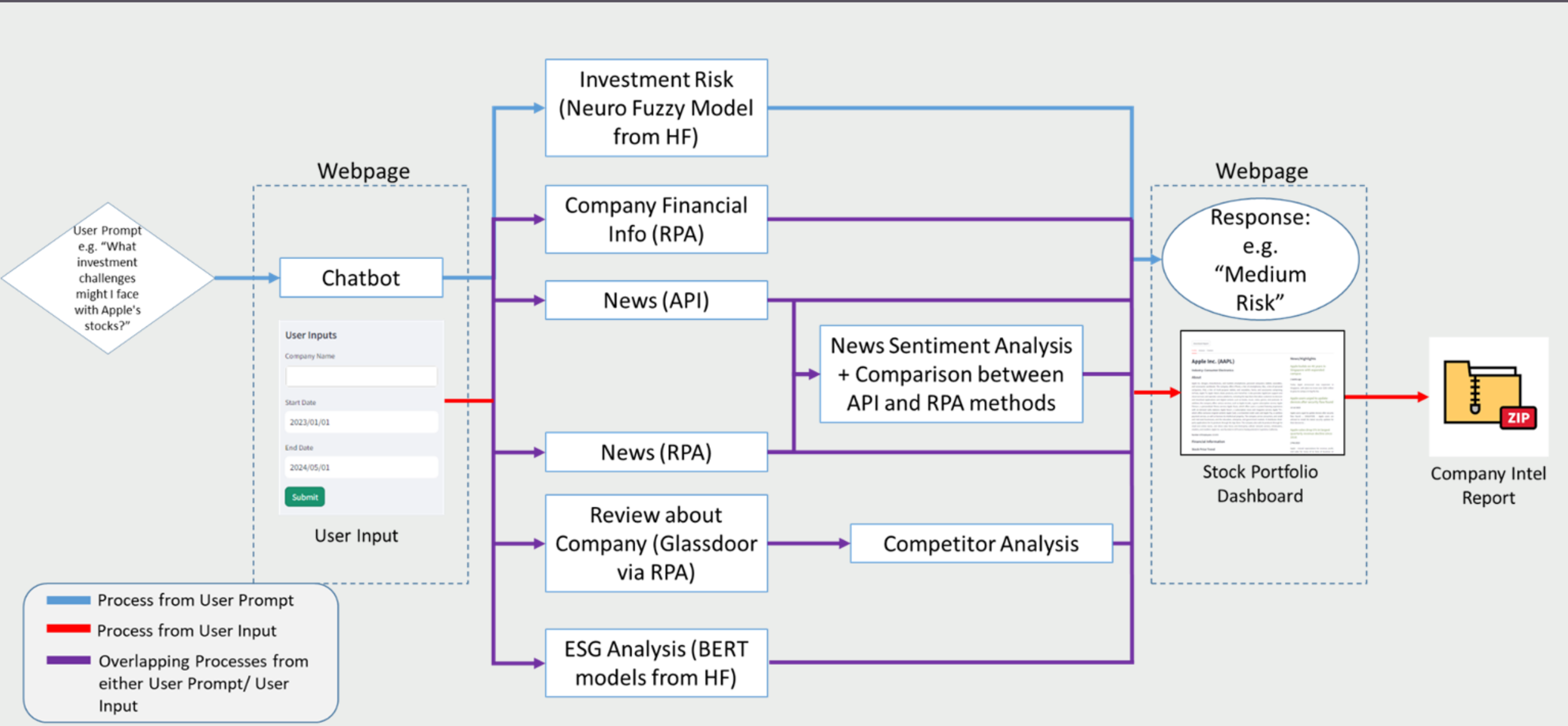
- Streamlined Platform for comprehensive information gathering
- Multiple Info Access thru Webpage Dashboard, Chatbot or Downloadable CSV Files

2. **System Features**

- Company background details, key financial metrics, and Glassdoor reviews extracted via RPA
- Real-Time News Informer Module leveraging RPA and API for up-to-date news coverage
- ESG Analysis conducted through RPA and AI integration for in-depth assessment
- Competitor Analysis facilitated via RPA for benchmarking and evaluation
- Financial Insights & Risk Assessment powered by Neuro-Fuzzy Model for precise analysis



SYSTEM OVERVIEW / WORKFLOW



TECHNICAL STACK

Frontend Dev

- **Technologies**: Streamlit
- **Interface**: Web pages presented using Streamlit, a Python framework ideal for machine learning or data science.
- **Interaction**: Frontend communicates with backend via Python function imports.

Backend Dev

- **Technologies**: Python
- **NLP Engine**: Manages chatbot interactions and processes user inputs.
- **ANFIS Neuro Fuzzy Model**: Provides investment risk analysis based on stock data.
- **Web Scraping**: Utilizes TagUI and yfinance for data extraction.

Databases

- **Technologies**: SQLite
- **Purpose**: Store training dataset for neuro fuzzy model

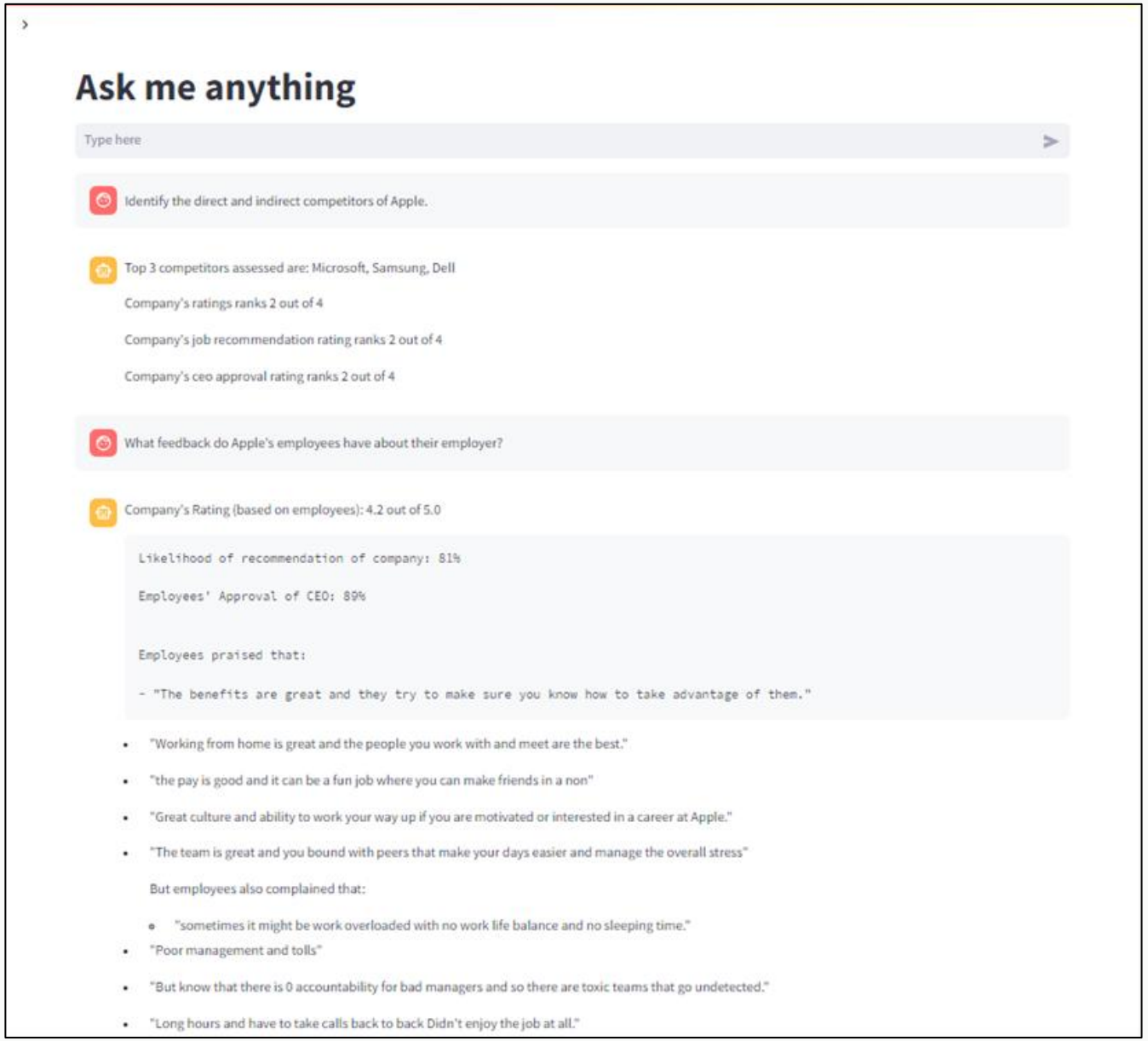
Security

- SQLite database ensures secure storage of user data and insights.

LLM CHATBOT

1. **Supervised Fine-Tuning Method**
- Locally fine-tuned Gemma-2B LLM

2. **Fine-tuned on Project-specific Conversational Messages**
- Accurately identify user intents
- Calls appropriate sub-systems



COMPANY BACKGROUND & FINANCIAL ANALYSIS

1. **Key Company Info and Financial Metrics**

- Explored TagUI, Beautiful Soup, and yFinance Python packages for data extraction.
- TagUI preferred choice due to versatility in navigating webpages and allowing searches via company name.
- Output stock profile Excel portfolio.

2. **Technical Analysis**

- TagUI to capture trend charts
- OpenCV to interpret stock price movements.
- Benchmarks for financial performance, future expert collaboration refinement.

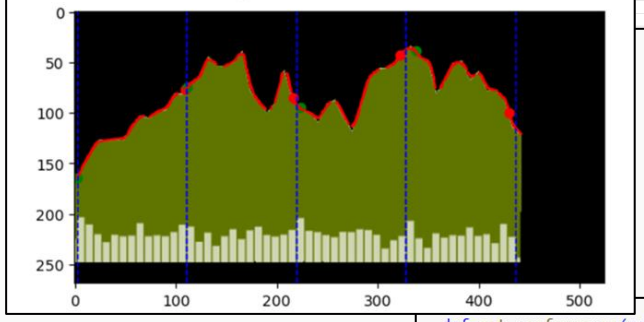
Records of stock profiles

Stock Market	Ticker Symbol	Currency	Previous Close	Open Price	Trade Daily Volume	Day Price Range	Day Low	Day High
			176.54	174.35	101,760,114	173.70 - 180.04	173.70	180.04
			169.12	169.15	69,861,226	168.49 - 170.73	168.49	170.73
		stry	Employee Count	Fwd Annual Dividend Rat	Fwd Annual Dividend Yiel	Trailing Annual Dividend F	Trailing Annual Dividend Yield	About Company
		Manufacturers	140,473	N/A	N/A	0.00	0.00%	Tesla, Inc. designs, develops, manufactures, lea
			161,000	0.96	0.57%	0.95	0.56%	Apple Inc. designs, manufactures, and markets s
			Current Ratio	Price-to-book Ratio	Key Personnel 1 Name	Key Personnel 1 Title	Key Personnel 1 Pay	Key Personnel 1 Exercised
			1.73	8.97	Mr. Elon R. Musk	Technoking of Tesla, CEO	N/A	N/A
			1.07	35.25	Mr. Timothy D. Cook	CEO & Director	16.24M	N/A
			Key Personnel 2 Exercise	Key Personnel 2 Year Bor	Key Personnel 2 Age	Key Personnel 3 Name	Key Personnel 3 Title	Key Personnel 3 Pay
			33.87M	1981	43	Mr. Vaibhav Taneja	CFO, Corporate Controller & Chief A	N/A
			N/A	1963	61	Mr. Jeffrey E. Williams	Chief Operating Officer	4.64M
			Key Personnel 4 Pay	Key Personnel 4 Exercise	Key Personnel 4 Year Bor	Key Personnel 4 Age	Key Personnel 5 Name	Key Personnel 5 Title
			N/A	N/A	N/A	N/A	Brian Szelfo	Senior Director of Corporate Development
			4.62M	N/A	1964	60	Ms. Deirdre O'Brien	Senior Vice President of Retail

Stock Trend Image Interpretation

```
# Example usage:
file_path = 'AAPL/1y_chart_20240308_1012.png'
generate_chart_description(file_path)
```

```
The tailend quarter reveals a decline in stock value that could be due to
wane in investor confidence, bearish market sentiment or economic headwinds
```



Generic Benchmark on Overall Financial Performance

```
def get_performance(ratio_value, ratio_name):
    value = convert_to_float(ratio_value)
    if ratio_name == "ROE":
        if value < 0.05:
            return "Poor"
        elif 0.05 <= value < 0.1:
            return "Fair"
        if 0.1 <= value < 0.2:
            return "Good"

        rn "Excellent"
    ame == "ROA":
        < 0.02:
        rn "Poor"
        2 <= value < 0.05:
        rn "Fair"
        5 <= value < 0.1:
        rn "Good"

        rn "Excellent"
    ame == "Net Profit Margin":
        < 0.05:
```

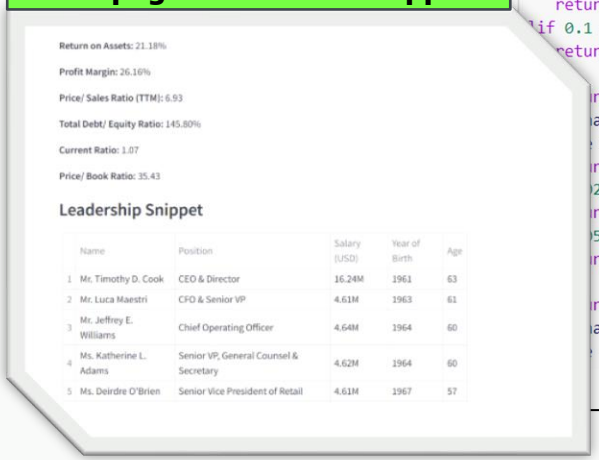
```
# Define thresholds
buy_threshold = 18  # Adjust as needed
sell_threshold = 12  # Adjust as needed

# Determine recommendation
if total_score >= buy_threshold:
    recommendation = "Buy"
elif sell_threshold <= total_score < buy_threshold:
    recommendation = "Hold"
else:
    recommendation = "Sell"

print("Overall Recommendation:", recommendation)
```

```
ROE Performance: Excellent
ROA Performance: Excellent
Net Profit Margin Performance: Excellent
Price to Sales Ratio Performance: Fair
Debt to Equity Ratio Performance: Fair
Current Ratio Performance: Fair
Price to Book Ratio Performance: Poor
Price to Earnings Ratio Performance: Fair
Overall Recommendation: Hold
```

Webpage Dashboard Snippet



COMPETITOR ANALYSIS

1. **Competitor Analysis via Glassdoor Review**

- TagUI to scrape key ratings, reviews and competitor data for benchmarking.

2. **Future Improvements**

- Can incorporate financial metric collection, technical analysis, news sentiment analysis and ESG scores for more comprehensive insights (that has already been done for company of interest).

TagUI competitor google search

```
top_competitors
['Microsoft', 'Samsung', 'Google']
```

TagUI scrapping Glassdoor

```
company_rating
'4.2'
job_recommendation
'80'
ceo_approval
'78'
pros_header
['Great benefits',
 'great and the people',
 'pay is good',
 'Great culture',
 'team is great']
pros_description
['"Great benefits and a nice feeling to be apart of a the worlds most valuable brand."\xa0(in 4986 reviews)',
 '"Working from home is great and the people you work with and meet are the best."\xa0(in 2542 reviews)',
 '"pay is good but expect to work a lot if you want to clime the latter up"\xa0(in 2247 reviews)',
 '"Great culture and ability to work your way up if you are motivated or interested in a career at Apple."\xa0(in 1042 reviews)',
 '"The team is great and you bound with peers that make your days easier and manage the overall stress"\xa0(in 721 reviews)']
cons_header
['No work life balance',
 'Poor management',
 'Long hours',
 'bad managers',
 'time off']
cons_description
['"No work life balance (made you feel bad about taking time off for mental health reasons)"\xa0(in 1408 reviews)',
 '"Poor management and tolls"\xa0(in 1269 reviews)',
 '"Long hours and have to take calls back to back Didn\'t enjoy the job at all."\xa0(in 838 reviews)',
 '"But know that there is 0 accountability for bad managers and so there are toxic teams that go undetected."\xa0(in 832 reviews)',
 '"They are very hard on you about taking time off and want you to always be at everything."\xa0(in 240 reviews)']
```

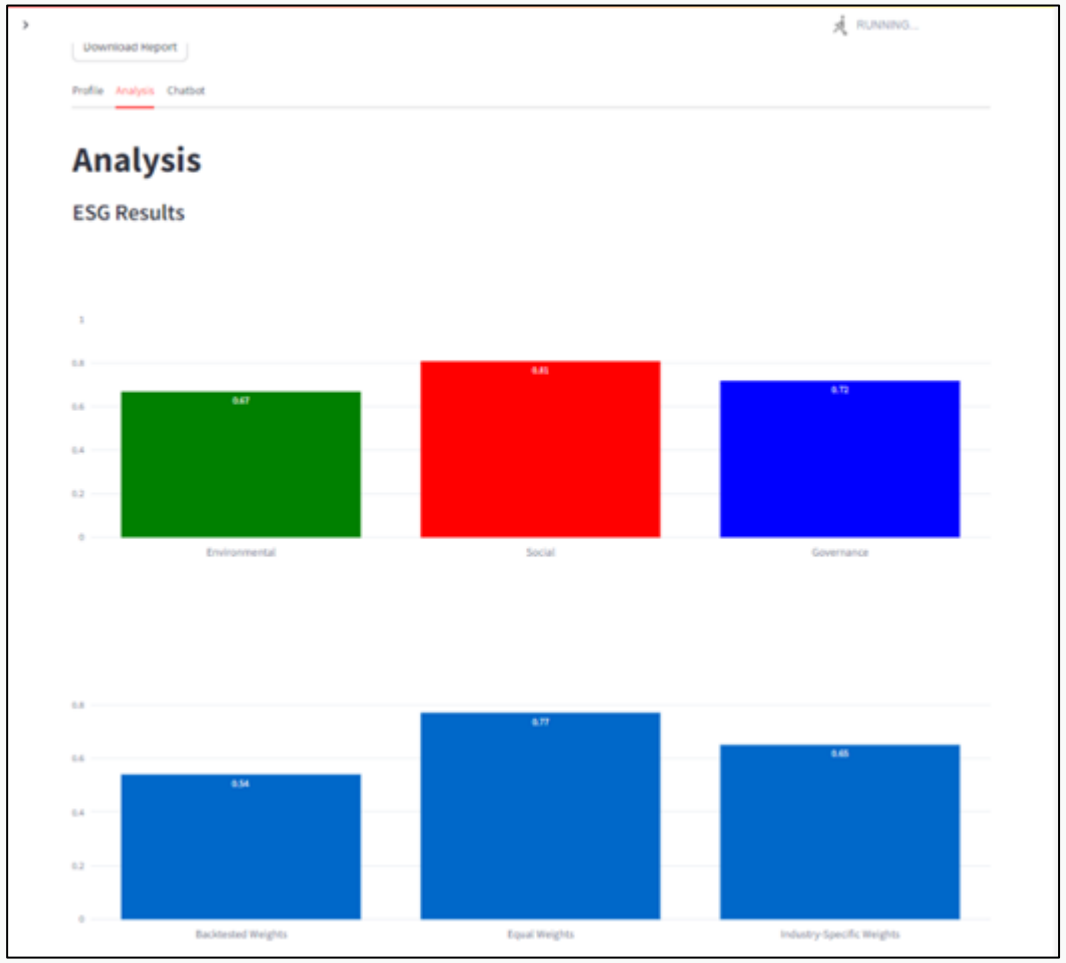
Benchmarking against Competitors

```
# Output Ranking:
print(f"{n} number of competitors assessed are: {top_competitors}")
print(f"{company}'s ratings ranks {company_rating_rank} out of {n+1}")
print(f"{company}'s job recommendation rating ranks {company_job_rec_rank} out of {n+1}")
print(f"{company}'s ceo approval rating ranks {company_ceo_app_rank} out of {n+1}")
```

```
3 number of competitors assessed are: ['Microsoft', 'Samsung', 'Google']
apple's ratings ranks 2 out of 4
apple's job recommendation rating ranks 3 out of 4
apple's ceo approval rating ranks 2 out of 4
```

ESG INTEGRATION

1. **Comprehensive ESG Perspective**
- Integrates environmental, social, and governance factors alongside traditional financial metrics.
2. **Specialized Analysis Models**
- Utilizes fine-tuned BERT models (EnvRoBERTa, SocialBERT, GovRoBERTa) for deep, nuanced analysis.
3. **Data Collection and Analysis**
- Automated data gathering, with specific scripts (analyze_environmental.py, analyze_social.py, analyze_governance.py) for each ESG aspect.
4. **Holistic Scoring**
- Synthesizes data into an over all ESG score, providing a multi-dimensional view of company performance.



ESG System Architecture and Impact

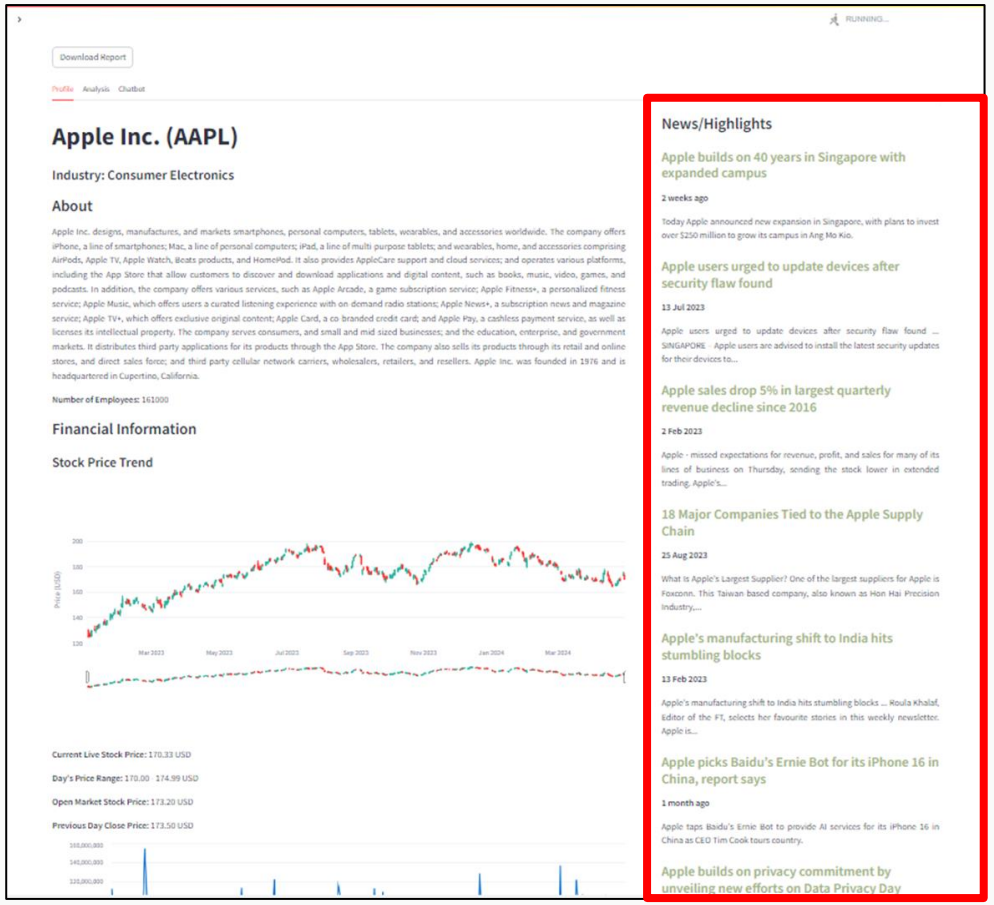
1. **Modular System Design**
- Clear separation of components for environmental, social, and governance data analysis.
2. **Real-time Data Processing**
- Uses API for real-time news and report scraping, ensuring up-to-date information.
3. **Scoring Flexibility**
- Different scoring approaches cater to diverse investor needs, allowing customized interpretation.
4. **Future Enhancements**
- Building proprietary AI models to further refine the accuracy of ESG scores, tailored to specific industry needs.

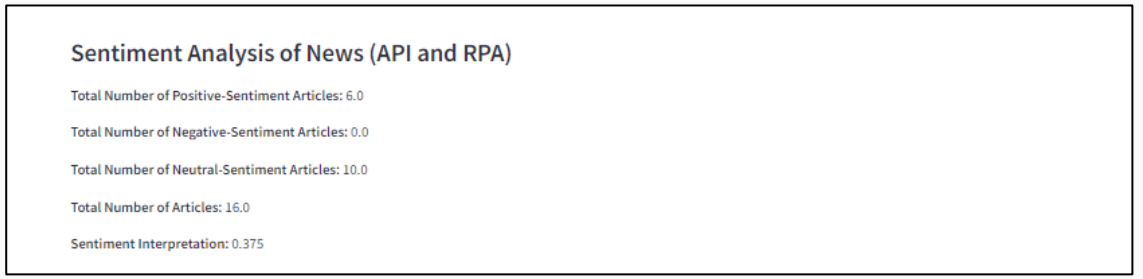
```python
from fetch_articles import ArticleFetcher
from store_articles import ArticleStore
from analyze_esg import EnvironmentalAnalyzer, SocialAnalyzer, GovernanceAnalyzer
from calculate_overall_esg import ESGScoreCalculator
```

```python
@staticmethod
def calculate_overall_esg_score(environmental_score, social_score, governance_score):
    # Define the weights for each ESG component based on the three different approaches.
    backtested_weights = [0.25, 0.05, 0.70]  # Backtested Weights: Best performance - Rank 1
    equal_weights = [1/3, 1/3, 1/3]          # Equal Weights: Second-best performance - Rank 2
    industry_weights = [0.30, 0.39, 0.31]    # Industry-Specific Weights: Third-best performance - Rank 3
```

REAL-TIME NEWS ANALYSIS

1. **News Scraper & Analysis Module Overview**
- Utilizes API and RPA for timely gathering and sentiment analysis of company-related news.
- Focuses on the last 48 hours of news for quick decision-making.
- Summarizes sentiment for prompt investor response..
2. **Integration of NewsAPI for Comprehensive Data Collection**
- Accesses diverse local and international media outlets.
- Retrieves both current and historical news using JSON format.
- Ensures broad coverage with access to over 150,000 sources.
3. **RPA for Dynamic News Scraping**
- Automates interactions with Google News using TagUI.
- Targets precise, current news items for real-time analysis.



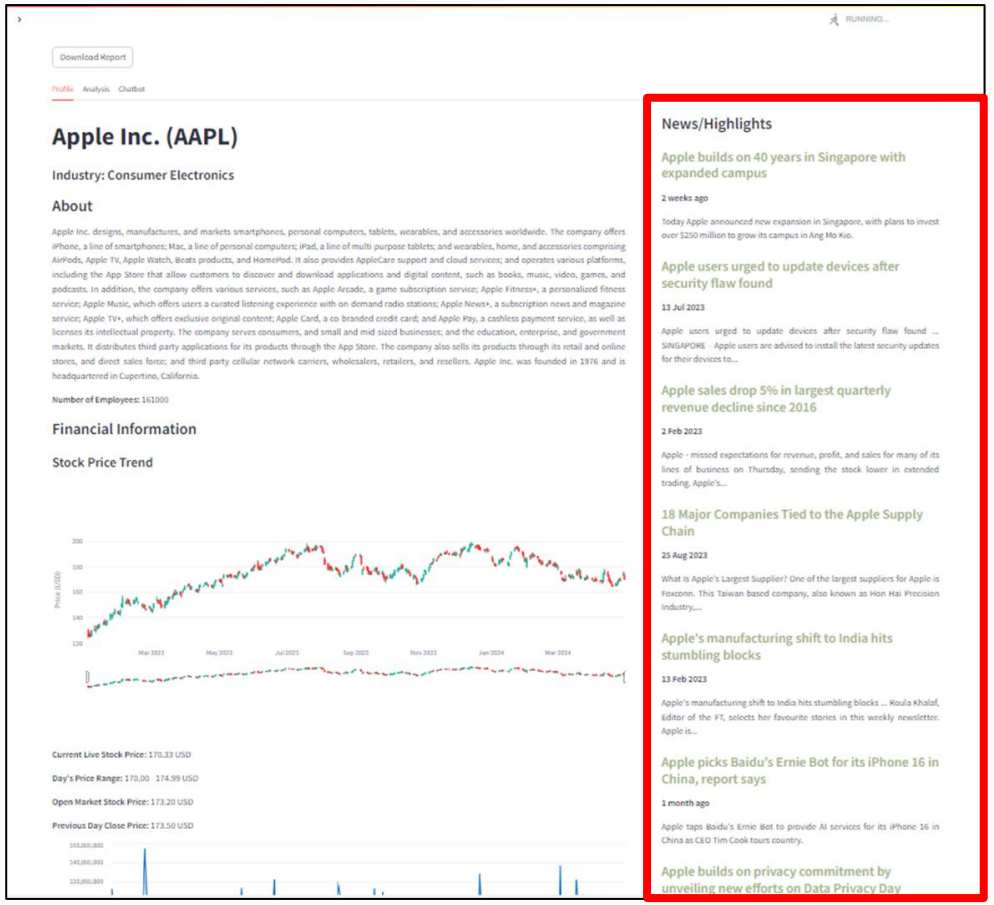


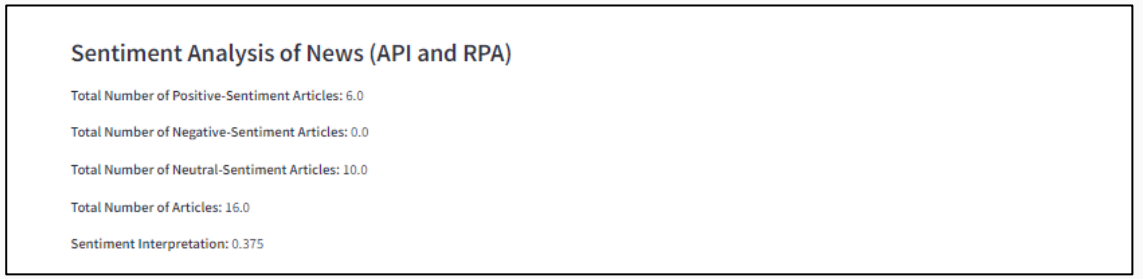
REAL-TIME NEWS ANALYSIS

4. **Enhancing Data Integrity Through Duplicate Removal**
- Utilizes TF-IDF vectorization and cosine similarity to eliminate duplicates.
- Maintains data integrity with a high similarity threshold.
- Enhances sentiment analysis quality by preventing redundancy.

5. **Segmented Sentiment Analysis**
- Analyzes sentiment in news articles using NLTK's VADER lexicon.
- Categorizes articles based on predefined thresholds.
- Provides a holistic view of sentiment for informed decision-making.

6. **Sentiment Summarization and Interpretation**
- Constructs a comprehensive sentiment summary.
- Calculates weighted average sentiment scores for straightforward market sentiment understanding.





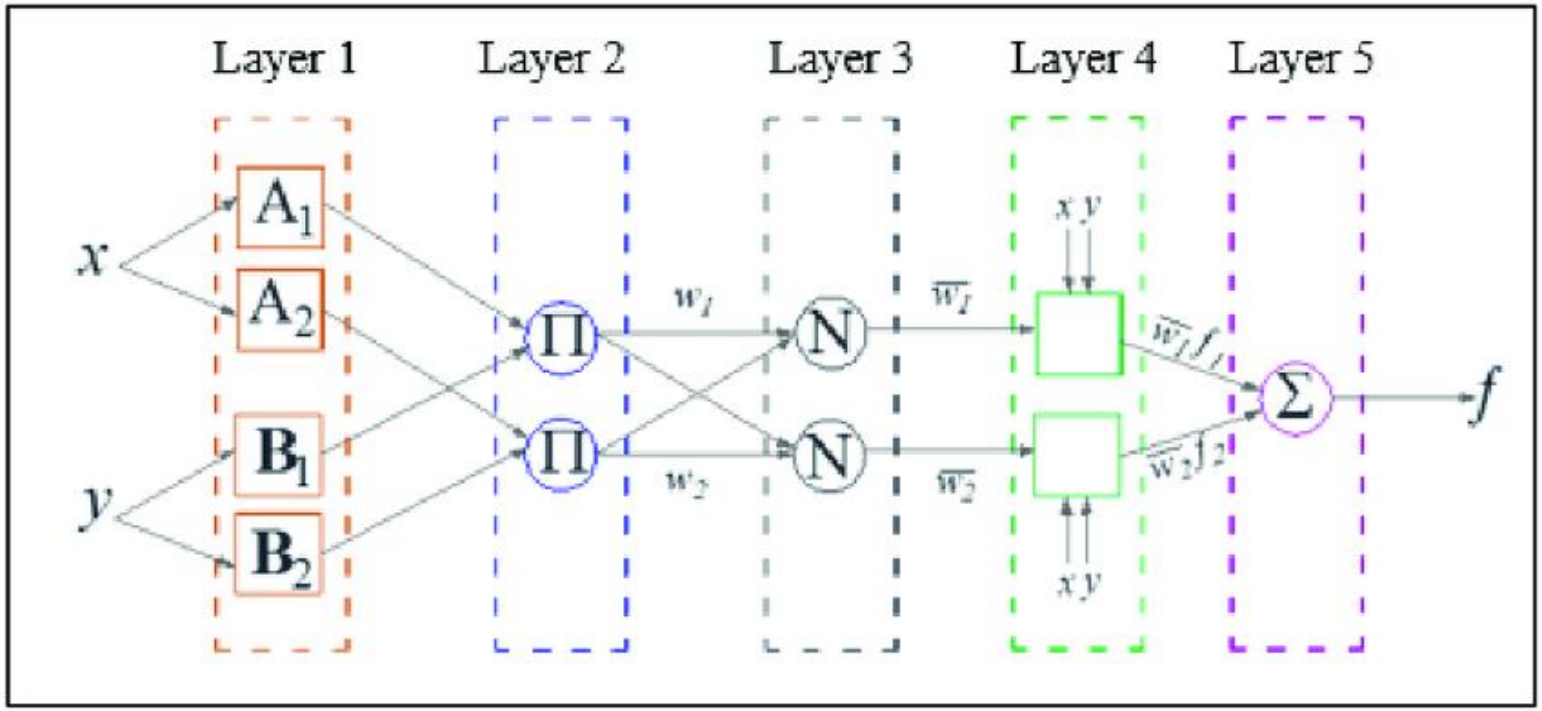
NEURO-FUZZY RECOMMENDER SYSTEM

Adaptive Neuro Fuzzy Inference System (ANFIS)

- A DL based hybrid model for predicting the stock risk of a company based on recent stock data and derived features

Layers of ANFIS Model

1. **Fuzzification layer**
- Transform crisp values into fuzzy values
2. **Rule Application Layer**
- Apply rules to the fuzzy variables
3. **Defuzzification Layer**
- Converts fuzzy variables back into crisp outputs



Thank you!

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