

Gemini Pro Financial Decoder: Transforming Complex Data into Actionable Insights

1. INTRODUCTION

Project Name : Gemini Pro Financial Decoder: Transforming Complex Data into Actionable Insights

Team Members and Roles:

1 Kuruva Pakkirappa Gari Swetha	-	Team Leader / Project Manager
2 Patan Arshiya	-	Frontend & UI Developer
3 Kille Naresh	-	Backend & API Developer
4 Shaik Suhail	-	AI & Data Analyst

2. PROJECT OVERVIEW

The Gemini Pro Financial Decoder is an AI-powered web application designed to simplify the analysis of complex financial data and transform it into clear, actionable insights. In today's data-driven financial environment, businesses and individuals generate large volumes of financial documents such as balance sheets, income statements, cash flow reports, and spreadsheets. Interpreting these documents manually requires significant time, expertise, and effort.

This project leverages the capabilities of Gemini Pro, a generative AI model, to automatically analyze financial documents and extract meaningful information. The system allows users to upload financial files in formats such as PDF, Excel, or CSV. After preprocessing and structuring the data, the AI engine generates summaries, identifies key financial metrics, detects trends and risks, and presents the results through interactive dashboards and downloadable reports.

The application is designed with a user-friendly interface, secure authentication, and scalable architecture to support multiple users and large datasets. By combining web technologies, data processing tools, and AI-driven analysis, the Gemini Pro Financial Decoder aims to reduce manual effort, enhance accuracy, and improve financial decision-making.

3. ARCHITECTURE



The architecture of the **Gemini Pro Financial Decoder** follows a modular and layered design to ensure scalability, security, and efficient data processing. The system is divided into multiple interconnected layers, each responsible for specific functionalities.

1. Presentation Layer (Frontend)

The frontend layer provides the user interface where users can:

- Log in securely
- Upload financial documents (PDF, Excel, CSV)
- Ask queries in natural language
- View generated insights, charts, and reports

This layer ensures smooth user interaction and visual representation of financial analysis results.

2. Application Layer (Backend API)

The backend layer handles:

- Processing user requests
- Managing document uploads
- Authentication and authorization
- Communication between frontend and AI engine

It ensures secure workflow management and data handling.

3. Data Processing Layer

Once documents are uploaded, this layer:

- Cleans and structures financial data
- Extracts relevant numerical and textual information
- Converts raw data into a format suitable for AI analysis

This step improves accuracy and consistency before sending data to the AI model.

4. AI Intelligence Layer

This is the core component of the system.

The Gemini Pro model:

- Analyzes financial data
- Extracts key metrics
- Identifies trends and anomalies
- Generates summaries and actionable insights

This layer transforms complex financial information into understandable explanations.

5. Data Storage Layer

The database layer securely stores:

- Uploaded documents
- Processed data
- Generated insights
- User logs and activity

It ensures data integrity and future retrieval.

6. Security Layer

Security mechanisms are applied across all layers, including:

- User authentication (JWT / OAuth2)
- Encrypted communication (HTTPS / SSL)
- Secure data storage

4. SETUP INSTRUCTIONS

4.1 System Requirements

Before installation, ensure the following are available:

- Python 3.9 or above

- Node.js (if frontend is used separately)
- Internet connection (for Gemini Pro API access)
- Code Editor (VS Code recommended)
- Git (optional)

4.2 Clone the Repository

```
git clone <repository-link>
cd gemini-financial-decoder
```

4.3 Create Virtual Environment

```
python -m venv .venv
```

Windows:

```
.venv\Scripts\activate
```

4.4 Install Required Dependencies

```
pip install -r requirements.txt
```

4.5 Configure Gemini Pro API Key

1. Create a .env file in the project folder.
2. Add your Gemini API key:

```
GOOGLE_API_KEY=your_api_key_here
```

4.6 Run the Backend Server

```
python app.py
```

4.7 Access the Application

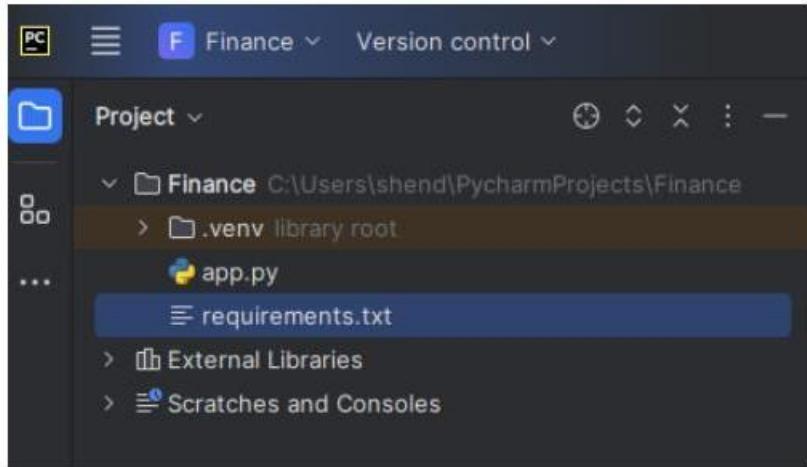
<http://localhost:8000>

4.8 Testing the Setup

- Upload a sample financial document (Excel/PDF)
- Verify that insights and summaries are generated
- Check logs for any errors

5. FOLDER STRUCTURE

The project follows a modular folder structure to ensure proper organization, scalability, and easy maintenance. Each folder is responsible for a specific functionality within the system.



- **frontend/** – Contains user interface components and dashboard implementation.
- **backend/** – Manages APIs, authentication, and request handling.
- **ai_engine/** – Handles Gemini Pro integration, prompt engineering, and financial insight generation.
- **data/** – Stores uploaded documents and generated reports.
- **database/** – Contains database connection and schema configuration.
- **.env** – Stores sensitive credentials such as API keys.

6. RUNNING THE APPLICATION

app.py

```
import streamlit as st  
  
import pandas as pd  
  
import numpy as np  
  
import os  
  
import google.generativeai as genai  
  
# -----  
# PAGE CONFIG (MUST BE FIRST)  
# -----  
st.set_page_config(page_title="Gemini Pro Financial Decoder")
```

```
# -----  
# APP TITLE (THIS WAS MISSING)  
# -----
```

```
st.title("Gemini Pro Financial Decoder")
st.write("Upload CSV files to generate AI-powered financial insights.")

# -----
# API KEY (CORRECT WAY)
# -----
API_KEY = os.getenv("GOOGLE_API_KEY")

if not API_KEY:
    st.error("⚠ GOOGLE_API_KEY not set")
    st.stop()

genai.configure(api_key=API_KEY)
model = genai.GenerativeModel("gemini-pro")

# -----
# FILE UPLOAD
# -----
st.subheader("⚡ Upload Financial Files")

balance_file = st.file_uploader("Balance Sheet CSV", type="csv")
pl_file = st.file_uploader("Profit & Loss CSV", type="csv")
cash_file = st.file_uploader("Cash Flow CSV", type="csv")

# -----
# FUNCTIONS
# -----
def load_csv(file):
    if file:
        return pd.read_csv(file)
    return None
```

```

def generate_summary(df, name):
    if df is None:
        return "⚠ No file uploaded"

    prompt = f"""
Analyze this {name} data and give:
- Key insights
- Strengths
- Weaknesses

Data:
{df.head(5)}
"""

    response = model.generate_content(prompt)
    return response.text

def visualize(df, title):
    if df is None:
        return

    st.subheader(title)
    st.dataframe(df)

    num = df.select_dtypes(include=np.number)
    if not num.empty:
        st.line_chart(num)

# -----
# BUTTON (THIS EXECUTES UI)
# -----
if st.button("⚡ Generate Report"):
    with st.spinner("Analyzing..."):

```

```

balance_df=load_csv(balance_file)
pl_df=load_csv(pl_file)
cash_df=load_csv(cash_file)

st.success(" <img alt='green checkmark' style='vertical-align: middle; height: 1em;"/> Analysis Complete")

st.markdown("## <img alt='blue BI icon' style='vertical-align: middle; height: 1em;"/> Balance Sheet")
st.write(generate_summary(balance_df, "Balance Sheet"))
visualize(balance_df, "Balance Sheet Data")

st.markdown("## <img alt='green H icon' style='vertical-align: middle; height: 1em;"/> Profit & Loss")
st.write(generate_summary(pl_df, "Profit & Loss"))
visualize(pl_df, "Profit & Loss Data")

st.markdown("## <img alt='red H icon' style='vertical-align: middle; height: 1em;"/> Cash Flow")
st.write(generate_summary(cash_df, "Cash Flow"))
visualize(cash_df, "Cash Flow Data")

```

7. API DOCUMENTATION

requirements.txt

- streamlit
- pandas
- matplotlib
- langchain
- langchain-google-genai
- google-generativeai

Dataset:

- Balance_sheet.csv
- Profit_and_loss.csv
- Cash_flow.csv

8. AUTHENTICATION

Authentication is a critical component of the Gemini Pro Financial Decoder system, as it handles sensitive financial data. The authentication mechanism ensures that only authorized users can access the platform and perform financial analysis.

The system implements a secure login and registration process using JWT (JSON Web Tokens) or OAuth2-based authentication. When a user logs in with valid credentials, the server generates a secure token. This token is used to verify the user's identity for subsequent requests without repeatedly asking for login details.

Authentication Workflow

1. User registers with email and password.
2. Password is securely hashed before storing in the database.
3. User logs in with valid credentials.
4. Backend verifies credentials and generates a JWT token.
5. The token is sent to the client and stored securely.
6. For every protected request, the token is validated by the backend.

Security Features

- Password hashing (e.g., bcrypt)
- Token-based authentication (JWT)
- Role-based access control (Admin/User)
- Secure communication using HTTPS (SSL/TLS)
- Protection against unauthorized access

Benefits of Authentication in the System

- Protects confidential financial documents
- Prevents unauthorized data access
- Tracks user activity for accountability
- Enhances system reliability and trust

9. USER INTERFACE

Gemini Pro Financial Decoder

Upload financial documents to view charts and AI-generated summaries.

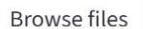
Upload Balance Sheet (CSV or XLSX)

Drag and drop file here
Limit 200MB per file • CSV, XLSX



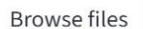
Upload Profit and Loss Statement (CSV or XLSX)

Drag and drop file here
Limit 200MB per file • CSV, XLSX



Upload Cash Flow Statement (CSV or XLSX)

Drag and drop file here
Limit 200MB per file • CSV, XLSX

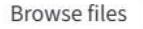


Gemini Pro Financial Decoder

Upload financial documents to view charts and AI-generated summaries.

Upload Balance Sheet (CSV or XLSX)

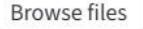
Drag and drop file here
Limit 200MB per file • CSV, XLSX



 balance_sheet.csv 104.0B 

Upload Profit and Loss Statement (CSV or XLSX)

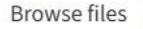
Drag and drop file here
Limit 200MB per file • CSV, XLSX



 profit_loss.csv 109.0B 

Upload Cash Flow Statement (CSV or XLSX)

Drag and drop file here
Limit 200MB per file • CSV, XLSX



 cash_flow.csv 120.0B 

10. TESTING

Testing is an essential phase in the development of the Gemini Pro Financial Decoder to ensure that the system functions correctly, performs efficiently, and meets user requirements. Various types of testing were conducted to validate system reliability, accuracy, and security.

1. Functional Testing

Functional testing was performed to verify that all system features work as expected.

Tested Functionalities:

- User registration and login
- Uploading financial documents (PDF, Excel, CSV)
- Data preprocessing and validation
- AI-based financial analysis
- Insight generation and visualization
- Report download functionality

2. Performance Testing

Performance testing was conducted to evaluate system responsiveness and stability under different loads.

Parameters Evaluated:

- Response time of AI-generated insights
- Document processing speed
- Handling multiple user requests
- System stability during batch uploads

3. Security Testing

Security testing ensured protection of sensitive financial data.

Security Checks Included:

- Authentication and authorization validation
- Token verification (JWT)
- Secure data transmission using HTTPS
- Prevention of unauthorized access

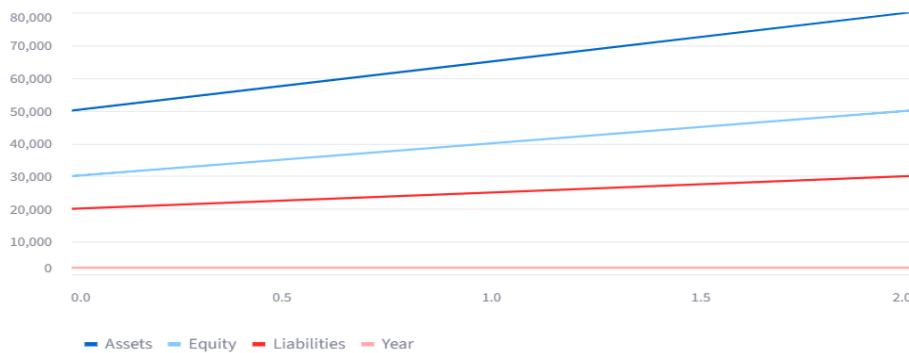
4. Usability Testing

Usability testing was conducted to ensure the interface is user-friendly and intuitive. Feedback was collected to improve navigation, clarity of insights, and dashboard design.

11. SCREENSHOTS

Balance Sheet

	Year	Assets	Liabilities	Equity
0	2021	50000	20000	30000
1	2022	65000	25000	40000
2	2023	80000	30000	50000



Generate AI Summary for Balance Sheet

AI Summary

As a financial analyst, here's a clear and simple summary of the provided Balance Sheet data, highlighting key trends and important insights:

Balance Sheet Analysis: 2021-2022 Summary

The company experienced significant growth and improved its financial structure between 2021 and 2022.

Key Trends & Insights:

1. Robust Asset Growth:

- Total Assets increased substantially from \$50,000 in 2021 to \$65,000 in 2022, representing a 30% increase. This indicates business expansion, potentially through increased operational capacity, investments, or successful sales driving asset accumulation.

2. Healthy Equity Expansion:

- Shareholder Equity saw the strongest proportional growth, increasing by \$10,000 (from \$30,000 to \$40,000), which is a 33.3% rise. This is a very positive sign, typically reflecting retained earnings from profitable operations or new equity investment, significantly enhancing the company's financial foundation.

3. Controlled Liability Growth & Improved Solvency:

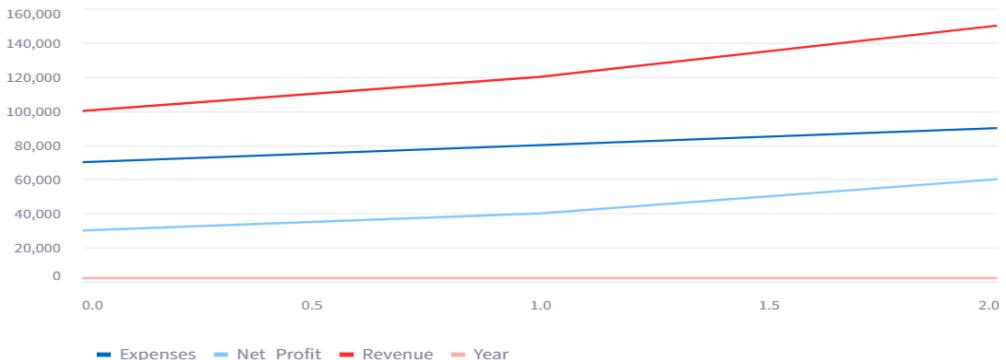
- Liabilities also rose by \$5,000 (from \$20,000 to \$25,000), representing a 25% increase.
- Crucially, liabilities grew at a slower rate than both assets and equity. This is a positive indicator.
- Improved Funding Structure:** The company's reliance on debt relative to equity has decreased. The Debt-to-Equity ratio improved from 0.67 (\$20,000/\$30,000) in 2021 to 0.63 (\$25,000/\$40,000) in 2022. This indicates better solvency and reduced financial risk, as a larger proportion of assets are now funded by owner's capital rather than borrowed money.

Overall Summary:

In summary, the company's balance sheet data reflects a financially growing and strengthening entity. The significant growth in its asset base, primarily funded by a robust increase in shareholder equity, coupled with a relatively lower reliance on debt, points to a healthy financial trajectory, improved solvency, and a more resilient financial position. This trend suggests strong operational performance and effective capital management.

Profit and Loss Statement

	Year	Revenue	Expenses	Net_Profit
0	2021	100000	70000	30000
1	2022	120000	80000	40000
2	2023	150000	90000	60000



Generate AI Summary for Profit and Loss Statement

AI Summary

Here's a clear and simple summary of the provided Profit and Loss Statement data, highlighting key trends and important insights:

Financial Performance Summary: 2021 vs. 2022

The company demonstrated strong financial growth and improved profitability between 2021 and 2022.

Key Trends & Insights:

1. Robust Revenue Growth:

- Revenue increased significantly from 100,000 in 2021 to 120,000 in 2022, representing a 20% year-over-year increase. This indicates effective sales strategies or expanding market demand.

2. Controlled Expense Management:

- Expenses rose from 70,000 in 2021 to 80,000 in 2022, an increase of 14.3%. Crucially, this growth rate in expenses was lower than the revenue growth rate.

3. Excellent Net Profit Expansion:

- Net Profit saw an impressive leap from 30,000 in 2021 to 40,000 in 2022, marking a 33.3% increase. This indicates a highly positive trend.

4. Improved Profitability Margin:

- The company's net profit margin (Net Profit / Revenue) improved from 30% in 2021 (30k/100k) to 33.3% in 2022 (40k/120k). This indicates that the company is not only growing sales but also becoming more efficient at converting those sales into profit.

Overall Conclusion:

The data suggests a very positive performance, with the company successfully growing its top-line revenue while effectively managing its expenses, leading to disproportionately higher growth in net profit and an improvement in overall profitability. This indicates strong operational leverage and a healthy financial trajectory.

Cash Flow Statement

	Year	Operating_Cash	Investing_Cash	Financing_Cash
0	2021	20000	-5000	3000
1	2022	25000	-7000	4000
2	2023	30000	-6000	5000



Generate AI Summary for Cash Flow Statement

AI Summary

Here's a summary and analysis of the provided Cash Flow Statement data:

Cash Flow Statement Summary & Analysis (2021-2022)

This company shows a positive and strengthening cash flow profile over the two-year period.

Key Trends and Important Insights:

1. **Strong and Growing Operating Cash Flow (OCF):**
 - **Trend:** Operating Cash Flow increased significantly from \$20,000 in 2021 to \$25,000 in 2022.
 - **Insight:** This is the most crucial takeaway. It indicates that the company's core business activities are highly profitable and generating an increasing amount of cash. This strong operational performance provides a solid foundation for funding growth and managing debt.
2. **Increased Investment in Growth (Investing Cash Flow):**
 - **Trend:** Investing Cash Flow remained negative, increasing from -\$5,000 in 2021 to -\$7,000 in 2022.
 - **Insight:** Negative investing cash flow typically means the company is spending money on assets (like property, plant, equipment, or acquisitions) for future growth. The *increase* in this outflow suggests a stepped-up commitment to capital expenditure or expansion initiatives. This is generally a positive sign of a forward-looking strategy, provided these investments yield good returns.
3. **Increased Capital Raising (Financing Cash Flow):**
 - **Trend:** Financing Cash Flow increased from \$3,000 in 2021 to \$4,000 in 2022.
 - **Insight:** Positive financing cash flow indicates the company is raising money through debt or equity. The increase suggests they brought in more capital from external sources in 2022. This additional capital could be used to support the increased investing activities, manage operations, or pay down existing obligations. Given the strong operating cash flow, this financing isn't necessarily a sign of distress but rather a strategic decision to fund growth or optimize the capital structure.

Overall Conclusion:

The company appears to be in a healthy financial position, demonstrating **robust and growing cash generation from its core business**. This allows them to significantly invest in their future through increased capital expenditures. While they are also raising additional capital through financing activities, the strong operating cash flow indicates they are generating more than enough cash internally to cover their current investment needs, providing flexibility and supporting their growth trajectory. This is generally a very favorable cash flow pattern, suggesting a well-managed and expanding enterprise.

12. KNOWN ISSUES

Although the Gemini Pro Financial Decoder performs efficiently, certain limitations and known issues were identified during development and testing.

1. Dependency on API Availability

The system relies on the Gemini Pro API for financial analysis. If the API service is unavailable or experiences latency, insight generation may be delayed.

2. Large File Processing Delay

Very large financial documents (high-page PDFs or large Excel files) may require additional processing time, affecting response speed.

3. Data Formatting Variability

Financial documents with inconsistent formatting, missing values, or non-standard structures may impact preprocessing accuracy.

4. Limited Context Understanding

In highly complex financial scenarios, AI-generated insights may require expert validation for complete reliability.

5. Internet Requirement

Since the system uses cloud-based AI services, a stable internet connection is necessary for proper functioning.

6. Scalability Under Heavy Load

Under very high concurrent user traffic, system performance may decrease unless additional cloud scaling is implemented.

13. FUTURE ENHANCEMENT

The Gemini Pro Financial Decoder has strong potential for further improvements and expansion. Future enhancements can make the system more intelligent, scalable, and user-friendly.

1. Real-Time Financial Data Integration

The system can be enhanced to integrate real-time stock market data, banking APIs, and accounting software to provide live financial analysis and updates.

2. Predictive Analytics & Forecasting

Advanced machine learning models can be incorporated to predict future financial trends, revenue growth, risk probability, and investment performance.

3. Multi-Language Support

Adding support for multiple languages will make the platform accessible to users from

different regions.

4. Explainable AI (XAI)

Implementing explainable AI techniques can help users understand how insights and recommendations are generated, increasing transparency and trust.

5. Mobile Application Development

Developing a mobile application will improve accessibility and allow users to analyze financial data on the go.

6. Advanced Risk & Fraud Detection

The system can be enhanced with anomaly detection and fraud analysis models for deeper financial risk assessment.

7. Cloud Deployment & Scalability

Future upgrades can include full cloud deployment with containerization (Docker/Kubernetes) to support large-scale enterprise usage.