

AI-Powered Smart Family Finance Management System with Investment Analytics and Wealth Prediction

Mrs. Satheeswari Muthuchamy¹, Mrs. Dr. Pasupathi Perumalsamy², Mrs. Nisha Rajaram³

^{1,3} Research Scholar, Department of Computer Science and Engineering,

Sri Vidya College of Engineering and Technology

² Professor and Head, Department of Computer Science and Engineering,

Sri Vidya College of Engineering and Technology, Virudhunagar, Tamil Nadu, India

Abstract - Personal finance management is a growing challenge for middle-class families, who must simultaneously track daily expenditure, manage a monthly salary and monitor a diverse portfolio of investments. Most existing tools address only one of these needs, forcing families to switch between disconnected applications. This paper presents Smart Family Financier, a full-stack web application that unifies expense tracking, salary management, investment portfolio management, financial reporting and rule-based advisory within a single dashboard. The client is a single-page application built with React and Vite, and the server is a stateless REST API built with Node.js and Express, secured using JSON Web Tokens. The investment module supports thirteen asset classes spanning traditional Indian instruments such as gold, fixed deposits, the Public Provident Fund and the National Pension System, and modern alternatives such as equities, mutual funds and cryptocurrency. Gold holdings are revalued in real time, a composite portfolio health score is computed from diversification, emergency-fund coverage and equity exposure, and a wealth-prediction engine projects value over multiple horizons. Evaluation on a representative family dataset of over one hundred and seventy expense records and eleven months of salary history shows that the platform computes the key financial indicators accurately and presents them in an intuitive, India-centric interface.

Key Words: Personal finance management, expense tracking, investment portfolio, portfolio health score, REST API, rule-based advisory.

1. INTRODUCTION

Money is central to the well-being of every household, yet managing it well remains difficult. A typical middle-class family earns a fixed monthly salary, spends across a wide range of categories such as food, housing, utilities, healthcare and education, sets aside a portion as savings, and invests the remainder in instruments ranging from gold and fixed deposits to mutual funds and equities. Keeping track of all of these activities, and understanding how they combine to determine the family's overall financial health, is a non-trivial task.

Smart Family Financier is a full-stack web application designed to address this problem. It brings expense tracking, salary management, investment portfolio management, financial reporting and artificial-intelligence-driven advisory together into a single, unified dashboard. The application is targeted at middle-class Indian families who need an easy-to-use tool to understand where their money goes, how their savings are growing and whether their investments are performing well. Its guiding philosophy is captured in the tagline "Smarter money decisions for your family."

1.1 Need for the Study

Most freely available personal finance tools focus on a single concern. Expense trackers record spending but ignore investments; portfolio trackers monitor market value but say nothing about household cash flow; and spreadsheets, while flexible, demand manual effort and offer no automation or guidance. As a result families are forced to switch between disconnected applications and rarely obtain a single accurate picture of their finances.

The need is particularly acute in the Indian context. Indian families hold a significant share of their wealth in physical gold, whose value fluctuates with the daily market rate, and they invest in country-specific instruments such as the Public Provident Fund (PPF), the National Pension System (NPS) and recurring deposits that generic foreign tools do not model. A platform that understands these instruments, values them accurately and presents everything in Indian Rupees with familiar date conventions therefore fills a real gap.

1.2 Objectives

The objectives of this work are: to design and implement a unified web platform that integrates expense tracking, salary management and investment portfolio

management; to support a comprehensive set of investment asset classes relevant to Indian families, including the live valuation of gold; to compute and present meaningful financial indicators such as the monthly savings rate, portfolio return and a composite portfolio health score; to generate personalized, rule-based advisory insights and to project future wealth over multiple time horizons; and to provide secure authentication while allowing data to be exported in both Excel and PDF formats.

2. REVIEW OF LITERATURE

This section surveys prior work relevant to the present project, examining existing approaches to personal expense management, the theory underlying investment portfolio management, the role of artificial intelligence in personal finance, and the architectural patterns used to build modern web applications.

2.1 Personal Expense Management

Digital expense management has evolved from simple spreadsheet-based bookkeeping to dedicated mobile and web applications that categorize transactions and visualize spending. Usability research has long argued that the value of such systems lies less in raw data capture than in presenting information in a form that supports decision-making. Effective expense tools therefore emphasize clear categorization, trend visualization and low data-entry effort. However, most of these tools treat expenditure in isolation and do not relate spending to income or to long-term wealth, limiting their usefulness for holistic family financial planning.

2.2 Investment Portfolio Management

The theoretical foundation of portfolio management is Modern Portfolio Theory, which formalized the idea that investors should evaluate assets in terms of their contribution to the risk and return of the overall portfolio, and that diversification reduces risk. This was extended by the Capital Asset Pricing Model, which related the expected return of an asset to its systematic risk. These ideas motivate the diversification and concentration metrics used in the present work. Standard texts on investments describe how individual investors can apply these principles through asset allocation and periodic rebalancing.

2.3 Artificial Intelligence in Personal Finance

Automated advisory systems, popularly known as robo-advisors, have brought algorithmic financial guidance to retail investors. Such systems typically assess a user's holdings against a set of heuristics — for

example, the adequacy of an emergency fund, the degree of concentration in a single holding, or the level of equity exposure — and generate tailored recommendations. The present project adopts a comparable rule-based advisory approach, computing a portfolio health score and producing actionable insights while keeping the underlying logic transparent and explainable.

2.4 Web Architectures and REST

The proposed system is built as a single-page application communicating with a server through a Representational State Transfer (REST) interface. The REST architectural style prescribes a stateless, resource-oriented model that scales well and decouples the client from the server. Practical treatments of RESTful service design and of layered enterprise application architecture inform the separation of concerns adopted here. Stateless authentication is achieved using JSON Web Tokens (JWT), a compact, self-contained mechanism for securely transmitting claims between parties.

2.5 Research Gap

The literature shows mature but fragmented solutions: expense trackers, portfolio managers and advisory systems each address one facet of personal finance. What is missing is an integrated, India-centric platform that combines all three facets, values country-specific instruments such as gold in real time, and presents a single coherent view of a family's financial health. The present work addresses this gap.

3. SYSTEM ARCHITECTURE AND METHODOLOGY

The system follows a classical client-server design with a clear separation between presentation, business logic and data.

3.1 System Architecture

The application adopts a three-tier client-server architecture. The presentation tier is a single-page application that runs in the browser on port 5173. It communicates over HTTP with the application tier, an Express REST API running on port 3000, which in turn reads from and writes to the data tier. All API endpoints are prefixed with `/api/` and every protected request carries a JWT. On the client, navigation is handled entirely in the browser using a client-side router, giving instant transitions without full reloads. The principal routes are the login page, the dashboard, the expenses page, the reports page and the investments page. Fig. 1 illustrates this arrangement.

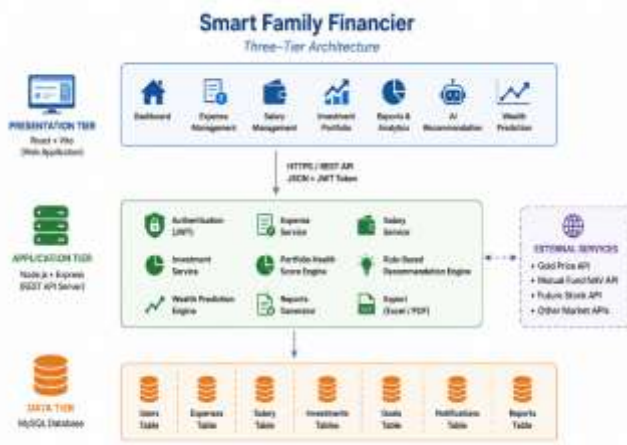


Fig. 3. Three-Tier Architecture of the Proposed Smart Family Financier System

Fig -1: Three-tier system architecture

3.2 Technology Stack

The application is built entirely with JavaScript technologies across the stack. The frontend libraries are summarized in Table 1 and the backend technologies in Table 2.

Table -1: Frontend technology stack

Technology	Purpose
React 19.1.1	User-interface framework (JSX components)
React Router DOM 7.9.5	Client-side routing for SPA navigation
Vite 7.1.14	Build tool and development server
Tailwind CSS 4.1.16	Utility-first CSS styling
Chart.js / Recharts	Canvas-based and React charting
Axios 1.13.1	HTTP client for API calls
XLSX 0.18.5	Excel file generation
jsPDF + AutoTable	PDF generation and table rendering

Table -2: Backend technology stack

Technology	Purpose
Node.js with Express	REST API server on localhost:3000
JSON Web Token (JWT)	Authentication and session management
CORS	Cross-Origin Resource Sharing

3.3 State Management and Security

Global application state, such as the investment data shared across several views, is managed using the React Context API through an investment context provider. Reusable business logic is encapsulated in custom hooks:

useInvestments centralizes portfolio data and useCountUp animates numeric values on summary cards. Authentication is stateless and based on JWTs. On successful login the server issues a token, which the client stores in local storage and includes in an Authorization: Bearer header on every protected request. Passwords can only be changed after current-password verification, and the e-mail address is immutable after account creation. Because the architecture is stateless, no server-side session storage is required.

4. SYSTEM DESIGN AND IMPLEMENTATION

The application comprises an authentication module, a dashboard, an expense management module, a reports module, an investment portfolio module, an external API integration layer, a data export module, and a cross-cutting validation layer.

4.1 Authentication and Dashboard

The login page authenticates a user by e-mail and password, offers a “Remember Me” option, and provides a forgot-password flow. On successful login a JWT is stored and the user is redirected to the dashboard. The dashboard is the central financial overview for a selected month. It presents four summary cards — Total Salary, Total Expenses, Total Savings and Savings Rate — together with a donut chart of expenses by category and a bar chart comparing salary with savings. Fig. 2 shows the dashboard.



Fig -2: Dashboard page

The dashboard aggregates the stored records for a chosen month. The total expense is the sum of the individual expense amounts, the net saving is the salary minus the total expense, and the savings rate expresses the saving as a percentage of the salary, as given in Eqs. (1) to (3).

$$E_m = \sum e_j \quad (1)$$

$$S = I - E_m \quad (2)$$

$$SR = (S / I) \times 100 \quad (3)$$

Here e_j is the amount of the j -th expense, I the monthly salary, E_m the total expense, S the net saving and SR the savings rate. For June 2026, with a salary of ₹75,000 and an expense of ₹27,839.20, the algorithm yields a saving of ₹47,160.80 and a savings rate of 62.9 per cent.

4.2 Expense and Reports Modules

The expenses page provides a complete create-read-update-delete interface for personal expenditure, with a paginated table, category and date-range filtering, free-text search, and a modal for adding expenses across fourteen categories. The reports page derives all-time analytics: the average monthly expense is the total expenditure divided by the number of active months, Eq. (4), and the highest-spending category maximizes the cumulative spend across categories, Eq. (5).

$$E_{avg} = (\sum E_m) / N \quad (4)$$

$$c^* = \arg \max_c T_c \quad (5)$$

Here N is the number of active months, T_c the cumulative spend in category c , and c^* the highest-spending category.

4.3 Investment Portfolio Module

The investment portfolio module is the most sophisticated part of the system. A summary dashboard presents five cards — Total Investment, Current Wealth, Total Profit/Loss, Overall Return % and Portfolio Health Score. A portfolio table lists each asset with its invested value, current value, profit or loss, allocation share and status, and three charts visualise allocation, invested-versus-current value, and profit and loss per asset class. The module supports thirteen asset types, listed in Table 3.



Fig -3: Investments dashboard

Table -3: Supported investment asset types

Asset Type	Asset Type
Gold	National Pension System
Stocks	Insurance
Mutual Funds	Real Estate
SIP	Cryptocurrency
Fixed Deposit	Government Bonds
Public Provident Fund	Recurring Deposit
Cash	

4.3.1 Valuation and Diversification

For each holding, the profit or loss is the current value minus the invested value, and the return is this profit expressed as a percentage of the investment, Eqs. (6) and (7). The allocation share is the current value as a fraction of the total portfolio value, Eq. (8).

$$P_i = C_i - V_i \quad (6)$$

$$R_i = (P_i / V_i) \times 100 \quad (7)$$

$$w_i = C_i / \sum C_j \quad (8)$$

Portfolio concentration is measured by the Herfindahl–Hirschman Index (HHI), the sum of the squared allocation shares, Eq. (9), mapped to a normalized diversification sub-score between 0 and 1, Eq. (10), where n is the number of holdings.

$$HHI = \sum w_i^2 \quad (9)$$

$$D = (1 - HHI) / (1 - 1/n) \quad (10)$$

4.3.2 Health Score and Advisory

The portfolio health score on a 0–100 scale is a weighted combination of three normalized sub-scores — diversification D , emergency-fund coverage E and equity-exposure adequacy Q — as in Eq. (11). The emergency-fund coverage is the ratio of liquid assets to six months of expenses, capped at one, Eq. (12).

$$H = 100 \times (\alpha D + \beta E + \gamma Q) \quad (11)$$

$$E = \min(L / (6M), 1) \quad (12)$$

Here L is the value of liquid assets and M the average monthly expense; the weights α , β and γ are non-negative and sum to one. For the sample portfolio this produces a health score of 51 out of 100, classified as moderate. Personalized recommendations are produced by a small set of production (IF–THEN) rules: if emergency-fund coverage is below six months, build an emergency fund; if the largest holding exceeds 40 per cent, reduce concentration; and if equity exposure falls below 20 per cent, increase equity exposure. Because the rules are explicit, every recommendation is transparent and explainable.

4.3.3 Wealth Projection

Future portfolio value is estimated by a deterministic compound-growth model, Eq. (13), where V_0 is the current value, t the horizon in years and r_b an allocation-weighted blended expected annual return.

$$V_t = V_0 (1 + r_b)^t \quad (13)$$

These algorithms are rule-based and statistical rather than learned from data. Estimating expected returns from historical prices using data-driven models — such as ARIMA or Long Short-Term Memory networks, regression-based return estimators, and k-means clustering for risk-profile segmentation — is identified as a machine-learning extension in the scope for future work.

4.4 APIs and Data Export

The backend consumes several services and re-exposes them through its own REST interface, summarized in Table 4. The live gold rate revalues gold holdings in real time, mutual fund net asset values are synchronized, and dedicated endpoints generate the advisory insights and wealth projections. Financial data can be exported to Excel using the XLSX library and to PDF using jsPDF with its AutoTable plugin.

Table -4: External APIs consumed by the backend

Service	Purpose
Gold Rate API	Live gold price per gram for valuing gold
Mutual Fund Sync API	Synchronizes mutual fund NAV data
AI Insights API	Generates personalized recommendations
Wealth Predictions API	Projects wealth at 6-month, 1-year, 5-year

5. RESULTS AND DISCUSSION

The system was evaluated on a representative family dataset comprising more than one hundred and seventy expense records spanning ten months from September 2025 to June 2026, eleven months of salary history, and a multi-asset investment portfolio.

5.1 Sample Results

Table 5 presents a snapshot of the principal figures for June 2026. The family earned a salary of ₹75,000 against total expenses of ₹27,839.20, yielding net savings of ₹47,160.80 and a savings rate of 62.9 per cent. Rent was the single largest expense at ₹18,000, roughly two-thirds of the month's spending.

Table -5: Sample data snapshot for June 2026

Metric	Value
Monthly salary	₹75,000
Total expenses	₹27,839.20
Net savings	₹47,160.80
Savings rate	62.9 %
Top expense	Rent (₹18,000)
Total portfolio value	₹13,46,875
Total invested	₹17,17,825
Portfolio profit / loss	-₹3,70,950 (-21.59 %)
Live gold rate	₹9,850 / gram

5.2 Portfolio Analysis

For the sample portfolio the system reports a total investment of ₹17,17,825 against a current wealth of ₹13,46,875, an overall loss of 21.59 per cent, and a portfolio health score of 51 out of 100, classified as moderate. The advisory layer identifies gold as the asset needing the most attention and surfaces three insights: insufficient liquid assets for an emergency fund, an over-concentrated single holding, and below-recommended equity exposure. The wealth-prediction engine projects the figures in Table 6 with a confidence score of 83 per cent and an explicit disclaimer that the figures are estimates rather than financial advice.

Table -6: Wealth prediction projections

Horizon	Projected	Growth %
6 Months	₹36,06,601	+14.8 %
1 Year	₹40,70,793	+29.5 %
5 Years	₹77,84,329	+147.7 %



Fig -4: Portfolio health and AI insights

5.3 Discussion

The results confirm that the platform computes its indicators correctly and presents them coherently. By relating spending to income and to long-term wealth within one view, it overcomes the fragmentation of existing tools and gives a family a single, accurate picture of its financial position. The moderate health score and the loss reported for the sample portfolio illustrate the value of the advisory layer: rather than merely reporting

figures, the system interprets them and tells the user what to do next. The principal limitation is the reliance on manually entered data and on a single blended growth assumption for projections, both addressed in the future work.

6. CONCLUSIONS

This paper has presented the design and implementation of Smart Family Financier, a full-stack web application that unifies expense tracking, salary management, investment portfolio management, financial reporting and rule-based advisory within a single dashboard. Built as a React single-page application backed by a stateless Node.js and Express REST API secured with JWTs, the system supports thirteen investment asset classes, revalues gold holdings in real time, computes a composite portfolio health score, generates personalized insights, projects future wealth and exports data to Excel and PDF. Evaluation on a representative family dataset demonstrated accurate computation of the key indicators in an intuitive, India-centric interface. Planned future work includes multi-member sub-accounts, category-level budgets, open-banking transaction import, live stock-market prices, an income-tax calculator, a React Native mobile application, and machine-learning-based spending-pattern analysis and anomaly detection.

ACKNOWLEDGEMENT

The author thanks the Department of Computer Science and Engineering, Sri Vidya College of Engineering and Technology, and the project supervisor for their guidance and support throughout this work.

REFERENCES

1. Markowitz, H.M.: Portfolio Selection. The Journal of Finance 7(1) (1952) 77–91
2. Sharpe, W.F.: Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. The Journal of Finance 19(3) (1964) 425–442
3. Bodie, Z., Kane, A., Marcus, A.J.: Investments. 10th edn. McGraw-Hill Education, New York (2014)
4. Fielding, R.T.: Architectural Styles and the Design of Network-based Software Architectures. Doctoral Dissertation, University of California, Irvine (2000)
5. Fowler, M.: Patterns of Enterprise Application Architecture. Addison-Wesley, Boston (2002)
6. Richardson, L., Ruby, S.: RESTful Web Services. O'Reilly Media, Sebastopol, California (2007)

7. Jones, M., Bradley, J., Sakimura, N.: JSON Web Token (JWT). RFC 7519, Internet Engineering Task Force (2015)
8. Nielsen, J.: Usability Engineering. Morgan Kaufmann, San Francisco (1994)