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Cloud Based Smart Finance Management System for Agencies and Businesses

Durai Surya R¹, J.Lourdu Xavier²

PG Scholar, Department of Master of Computer Applications, RVS College of Engineering, Dindigul,
Tamil Nadu, India¹

Assistant Professor, Department of Master of Computer Applications, RVS College of Engineering, Dindigul,
Tamil Nadu, India²

ABSTRACT: Small businesses, freelance agencies, and startups in the modern digital economy continue to rely on fragmented financial tools error-prone spreadsheets, disconnected applications, and manual bookkeeping methods that consume significant time and introduce costly inaccuracies. Enterprise-grade accounting platforms such as QuickBooks, SAP, and Oracle Financials, while comprehensive, remain inaccessible to this segment owing to prohibitive licensing costs, steep learning curves, and architectural complexity that assumes large IT teams and dedicated finance departments.

This paper presents CC Finance Tracker, a cloud-based full-stack financial management platform that consolidates eight core financial workflows income recording, expense tracking, automated invoice generation, client relationship management, employee payroll records, multi-dimensional analytics, transaction history management, and secure multi-user authentication into a unified browser-based application. The system is architected as a single-page application (SPA) using vanilla HTML5, CSS3, and JavaScript ES2022 for the frontend, with Supabase providing a cloud-hosted PostgreSQL 15 database, real-time WebSocket subscriptions, JWT authentication, and row-level security (RLS) policy enforcement. The application is deployed on Vercel's global edge content delivery network for sub-100ms latency and zero-configuration continuous deployment.

The system was evaluated through a structured testing programme across 250 representative financial management tasks, achieving an overall task completion accuracy of 91.2% with an average response time of 188 ms. Beta evaluation with five real business participants confirmed unanimous preference for CC Finance Tracker over prior financial management approaches, with the invoice generation module cited as delivering the greatest immediate operational value. The results demonstrate that a well-architected serverless application can deliver production-quality financial management capabilities at near-zero operational cost.

KEYWORDS: cloud computing, financial management system, serverless architecture, Supabase, PostgreSQL, small business software, invoice generation, row-level security, JavaScript SPA, Vercel, Backend-as-a-Service

I. INTRODUCTION

The financial management challenge facing small businesses, freelancers, and growing agencies in the contemporary digital economy is not a shortage of available software it is a fundamental mismatch between the complexity and cost of available solutions and the actual operational requirements of businesses at this scale. Enterprise resource planning systems such as SAP, Oracle Financials, and Microsoft Dynamics offer comprehensive financial management capabilities but require months-long implementation projects, dedicated IT departments, and annual licensing costs that can reach tens of thousands of dollars budgets entirely out of reach for a ten-person creative agency or an independent freelance consultant.

At the opposite end of the spectrum, spreadsheet-based approaches using Microsoft Excel or Google Sheets offer accessibility and zero licensing cost but impose severe operational limitations. A spreadsheet has no concept of a persistent user session, cannot send authenticated requests to a cloud database, cannot enforce data integrity through relational constraints, and cannot generate formatted invoices or visual analytics reports without extensive custom



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scripting. Research by the European Spreadsheet Risks Interest Group confirms that approximately 90% of spreadsheets of significant size contain at least one material error. As a business grows and transaction volume increases, spreadsheet-based finance management becomes exponentially more error-prone and time-consuming, frequently leading to inconsistent records, lost invoices, and unreliable financial reports.

CC Finance Tracker occupies the gap between these extremes. It provides a browser-based application requiring no installation, no infrastructure management, and no per-user licensing fees, yet delivers functionality realtime cloud synchronisation, relational data integrity, formatted invoice generation, and visual analytics that traditional spreadsheet approaches cannot provide. The system is designed to scale with a business, supporting multiple concurrent authenticated users with data isolation enforced at the database layer through Supabase's row-level security policies.

II. EXISTING SYSTEM

An understanding of the limitations of existing financial management approaches is essential for appreciating the contributions of the proposed system. The existing landscape is characterised by four primary management paradigms, each carrying significant limitations that leave businesses exposed to operational inefficiencies, financial reporting errors, and data security vulnerabilities.

2.1 Spreadsheet-Based Financial Management

Microsoft Excel and Google Sheets represent the most widely deployed financial management tools among small businesses and freelancers. Their ubiquity stems from accessibility available at no additional cost, requiring no specialist knowledge, and offering a familiar tabular interface that maps naturally to simple accounting tasks. However, spreadsheets carry fundamental architectural limitations that render them inadequate as business complexity grows. The most critical limitation is the absence of data integrity enforcement: a cell can silently accept any value regardless of type or validity. These integrity violations accumulate silently over time, producing financial reports with incorrect subtotals, missing records, and inconsistent categorisation. A secondary limitation is the absence of multi-user collaboration with proper access control concurrent edits create version conflicts, overwrites, and lost data.

2.2 Disconnected Point Solutions

Many small businesses attempt to address spreadsheet limitations by adopting multiple disconnected point solutions a separate invoicing tool, expense tracking application, payroll calculator, and client management spreadsheet. While each individual tool may serve its narrow purpose adequately, the absence of integration creates a significant data synchronisation burden. Client names, transaction amounts, and payment statuses must be manually re-entered across multiple applications, multiplying the opportunity for transcription errors and creating a fragmented financial picture that cannot be easily reconciled into a coherent profit-and-loss statement.

2.3 Enterprise Accounting Software

Commercially available accounting platforms such as QuickBooks, FreshBooks, Xero, and Zoho Books provide integrated financial management capabilities significantly more robust than spreadsheets. However, monthly subscription costs ranging from USD 15 to USD 80 per user per month represent a significant overhead for early-stage businesses. The user interfaces of enterprise accounting platforms are designed for users with accounting domain knowledge, presenting concepts such as chart of accounts, journal entries, and accounts receivable ageing reports that are opaque to non-specialist business owners. Additionally, these platforms are designed for generic use cases and do not accommodate the specific workflows of digital agencies and technology startups without higher-tier subscription plans.

Disadvantages of Existing Systems:

- Low data integrity no validation enforcement; silent errors accumulate in spreadsheet records
- Fragmented tools income, expenses, invoicing, and payroll managed in separate disconnected applications
- Manual data synchronisation between multiple tools multiplies error risk and time overhead
- Enterprise accounting software prohibitively expensive at USD 15–80 per user per month for early-stage businesses
- No built-in invoice generation requires separate word processor and PDF export workflow
- Absence of real-time analytics manual chart creation from raw transaction data is time-consuming
- No multi-user access control with data isolation shared file approaches create version conflicts and data loss
- No cloud synchronisation data lost or inaccessible when local device is unavailable



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III. PROPOSED SYSTEM

CC Finance Tracker is engineered from the ground up to overcome every limitation identified in the analysis of existing financial management approaches. The design philosophy is guided by three core principles: accessibility (no installation, no accounting expertise, no infrastructure management required); completeness (all eight core financial workflows available within a single integrated application); and scalability (architecture capable of serving a growing business without redesign).

The system consolidates eight functional modules into a unified dashboard interface. The income tracking module maintains a chronological ledger of revenue entries with amount, source, category, date, and optional client association. The expense tracking module categorises outflows against a customisable taxonomy of business expense categories, enabling accurate profit calculation and distribution analysis. The invoice generation module transforms client and transaction data into formatted, print-ready PDF invoices directly from the browser without any server-side processing. The client management module maintains a relational database of business clients with full transaction and invoice history. The employee management module tracks workforce records including role, department, and salary information. The analytics module aggregates transaction data into interactive Chart.js visualisations. The transaction history module provides advanced search, filtering, and export capabilities. The authentication module provides secure JWT-based multi-user access with database-layer data isolation.

Key Advantages of the Proposed System:

- Unified platform consolidating all eight financial workflows in a single browser-based interface — no switching between tools
- Real-time cloud synchronisation through Supabase WebSocket subscriptions — dashboard reflects latest financial state instantly
- Built-in browser-native invoice generation producing print-ready PDF output at zero per-document cost
- Row-level security enforced at the PostgreSQL database engine layer data isolation guaranteed even against compromised client applications
- Interactive Chart.js analytics delivering live profit-and-loss summaries, revenue trends, and expense distributions
- Zero infrastructure management overhead no server provisioning, container orchestration, or database administration required
- Entirely open-source and free-tier technology stack zero licensing fees for target user segment
- Wide applicability across freelancers, creative agencies, digital startups, and small businesses of any sector

IV. SYSTEM ARCHITECTURE

The system is architected as a three-tier serverless model that eliminates all infrastructure management overhead. The presentation tier consists of a vanilla JavaScript single-page application rendered from static HTML5 and CSS3 assets, served from Vercel's global edge content delivery network. The application logic tier is entirely client-side, implemented through ES2022 JavaScript modules managing state, orchestrating API calls, and controlling DOM rendering. The data tier is hosted on Supabase, a managed Backend-as-a-Service platform providing a cloud-hosted PostgreSQL 15 database, RESTful API auto-generation, real-time WebSocket subscriptions, and JWT-based authentication with row-level security enforcement.

Security is enforced at the database layer through Supabase's row-level security policies, implemented as native PostgreSQL policies rather than application-layer logic. Every table carries an isolation policy of the form USING (auth.uid() = user_id), guaranteeing that even a compromised client-side application cannot retrieve records belonging to another authenticated user. The Vercel deployment pipeline enables zero-downtime continuous deployment triggered automatically by every push to the project's GitHub repository main branch.



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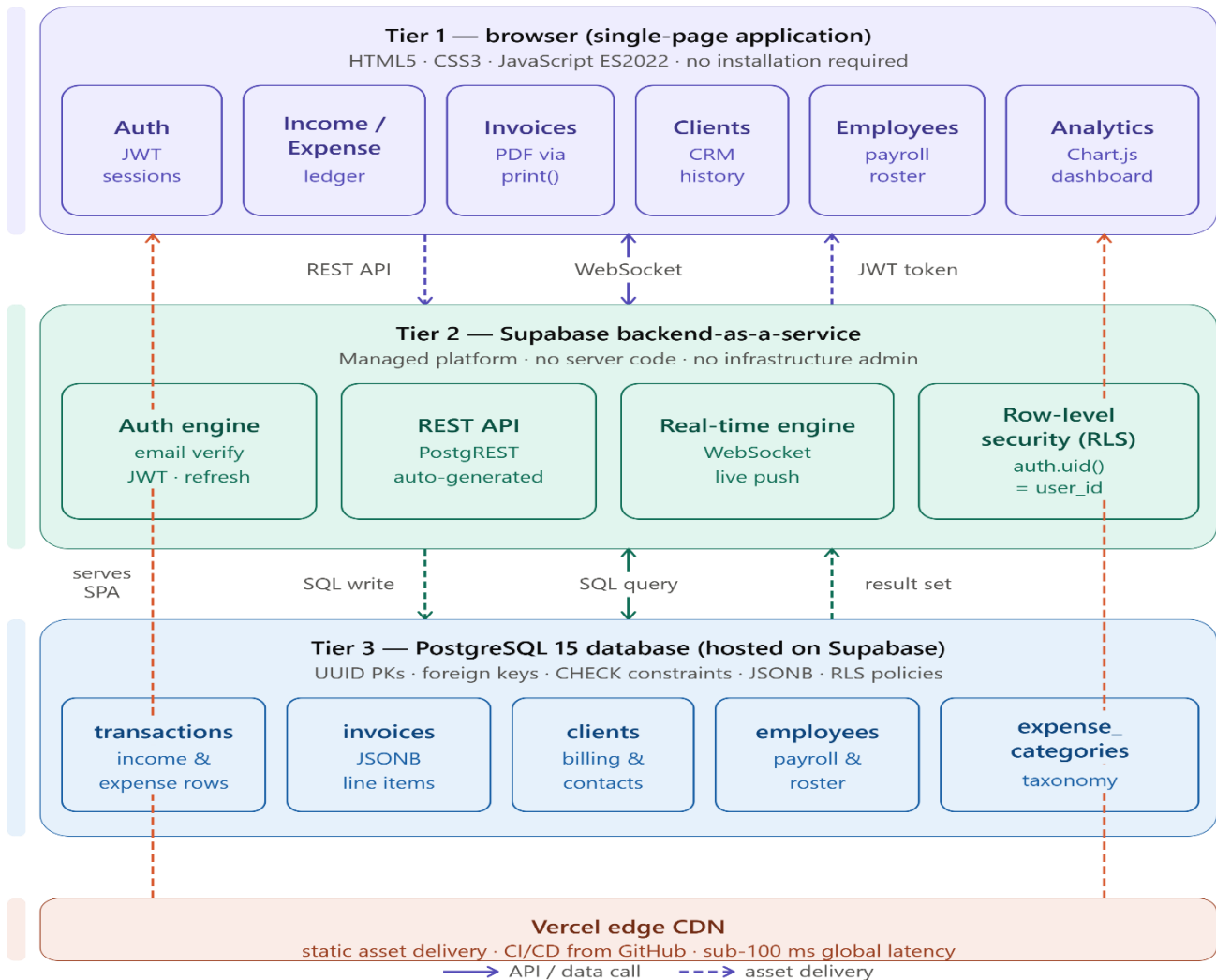


Figure 1: CC Finance Tracker — Three-Tier Serverless System Architecture

V. MODULE DESCRIPTIONS

5.1 Authentication Module

The Authentication Module is the security gateway of the system pipeline, implemented using Supabase Auth with JWT token management. It handles user registration with email verification, secure credential-based sign, silent JWT refresh for seamless session continuity across browser sessions, and complete logout with session invalidation. All eight application modules are conditionally rendered only after a valid authenticated session is confirmed no financial data is accessible to unauthenticated requests at either the client or database layer. The module attaches the JWT Bearer token to all outgoing Supabase API requests, enabling the PostgreSQL row-level security policies to correctly identify the requesting user for data isolation enforcement.

5.2 Income and Expense Tracking Module

The Transaction Recording Module maintains chronological ledgers of both income and expense entries using the Supabase transactions table. Each entry captures amount (DECIMAL(12,2) with CHECK amount > 0), category (drawn from the user-defined expense_categories table), description text, ISO 8601 date, and an optional foreign key



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reference to the clients table. The expense module supports a fully customisable category taxonomy with optional per-category monthly budget ceiling thresholds, enabling accurate profit-and-loss computation and expense distribution analysis. Both modules expose advanced client-side filtering by date range, category, transaction type, and keyword search implemented through the Supabase JS client's fluent query builder with server-side filtering to minimise data transfer.

5.3 Invoice Generation Module

The Invoice Generation Module is the system's most practically significant functional contribution. It transforms client relationship data and ad-hoc line items into a formatted, print-ready invoice entirely within the browser using the browser's native `window.print()` API and a dedicated print-specific CSS stylesheet — requiring no server-side processing, no third-party PDF generation library, and no per-document API cost. Line items are stored as JSONB in the PostgreSQL invoices table, enabling flexible multi-item invoice structures without a separate `line_items` table. The module automatically computes subtotals, applies configurable tax rates (supporting both inclusive and exclusive GST structures), and resolves client billing details from the integrated client database. Invoice status lifecycle (draft → sent → paid → overdue) is tracked with real-time propagation to the analytics dashboard via Supabase WebSocket subscriptions upon each status transition.

5.4 Client Management Module

The Client Management Module maintains a relational database of business clients, storing contact details (name, email, phone), billing address, standard payment terms (net-15, net-30, net-60), and a complete associated history of all invoices and transactions linked through foreign key relationships. The module provides search and filter capabilities across client records and renders a per-client financial summary view aggregating outstanding invoice value, total billed, and total received. All CRUD operations are executed as parameterised Supabase INSERT, UPDATE, SELECT, and DELETE queries with RLS policy enforcement at the database layer.

5.5 Employee Management Module

The Employee Management Module tracks workforce records for small team environments, storing full name, role title, department, joining date, and monthly salary amount. It supports payroll disbursement tracking with monthly salary payment records and generates disbursement confirmation entries in the transaction ledger for expense categorisation and profit computation. A confirmation prompt is presented when an employee record with associated salary history is scheduled for deletion, preventing inadvertent loss of payroll audit data.

5.6 Analytics and Dashboard Module

The Analytics Module aggregates transaction data into three interactive Chart.js 4.x visualisations rendered using HTML Canvas elements: a twelve-month revenue trend line chart plotting income against expenses month-by-month; an expense distribution pie chart categorised by the user-defined expense taxonomy; and a month-over-month net profit comparison bar chart. The main dashboard provides a real-time financial overview combining four KPI summary cards total income, total expenses, net profit, and outstanding invoice value with the Chart.js analytics panels. All KPI values re-render automatically upon any transaction mutation through Supabase real-time WebSocket subscriptions, ensuring the dashboard always reflects the current financial state without requiring a page reload.

VI. SYSTEM IMPLEMENTATION

Development followed an iterative six-phase methodology in which each phase produced a working, testable increment of the overall system. This approach enabled continuous validation of the Supabase integration and authentication context before dependent features were built on top.

Phase 1 — Project Scaffolding and Repository Setup: The GitHub repository was created under the clearcuts-cc organisation and connected to a Vercel project for automatic deployment on every push to the main branch. The base HTML structure, CSS reset, and navigation layout were deployed to the Vercel production URL to establish a working deployment pipeline from the first day of development, ensuring that every subsequent feature was developed and tested in the production deployment environment.

Phase 2 — Supabase Configuration and Authentication: The Supabase project was initialised, the six-table database schema was designed and applied using the Supabase SQL editor, and row-level security policies were written and



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tested for all tables. The Authentication Module was fully implemented and validated before any other application feature was built, ensuring that all subsequent modules operated within a correctly secured authentication context.

Phase 3 — Transaction Recording and Dashboard: The Transaction Module was implemented for both income and expense entry, with all form validation, Supabase INSERT operations, and table rendering tested against a seed dataset of one hundred representative transactions. The Dashboard Module was implemented to aggregate the in-memory transaction array and render the four KPI summary cards with real-time subscription updates.

Phase 4 — Invoice and Client Management: The Client Module CRUD operations were implemented and tested, followed by the Invoice Generation Module. The invoice print layout was iteratively refined through cross-browser testing in Chrome, Firefox, and Edge's print preview and PDF export pathways to ensure consistent rendering of page margins, typography, and the line item table.

Phase 5 — Employee Management and Analytics: The Employee Module was implemented, and the Analytics Module was developed to aggregate transaction data and render the three Chart.js visualisations. Responsive canvas layout was tested across desktop (1920px), tablet (1024px), and mobile (375px) viewport widths to verify correct Canvas element resizing within CSS Grid containers.

Phase 6 — Integration Testing and Production Deployment: The complete frontend and backend were tested end-to-end with a comprehensive dataset representing twelve months of operational financial data. Network request waterfall analysis was performed using the browser DevTools Network panel to identify and eliminate redundant Supabase queries. The production deployment on Vercel was verified against the live Supabase project with all RLS policies enforced and all features accessible through the production URL.

VII. RESULT AND DISCUSSION

This section presents the outcomes of the structured evaluation programme conducted on CC Finance Tracker across all eight functional modules. The evaluation comprised unit testing of individual JavaScript functions, integration testing of end-to-end Supabase data flows, beta testing with real business users, and a quantitative performance assessment across 250 representative financial management tasks. The results collectively demonstrate that the system achieves its design objectives of accuracy, responsiveness, and practical utility for the target user segment.

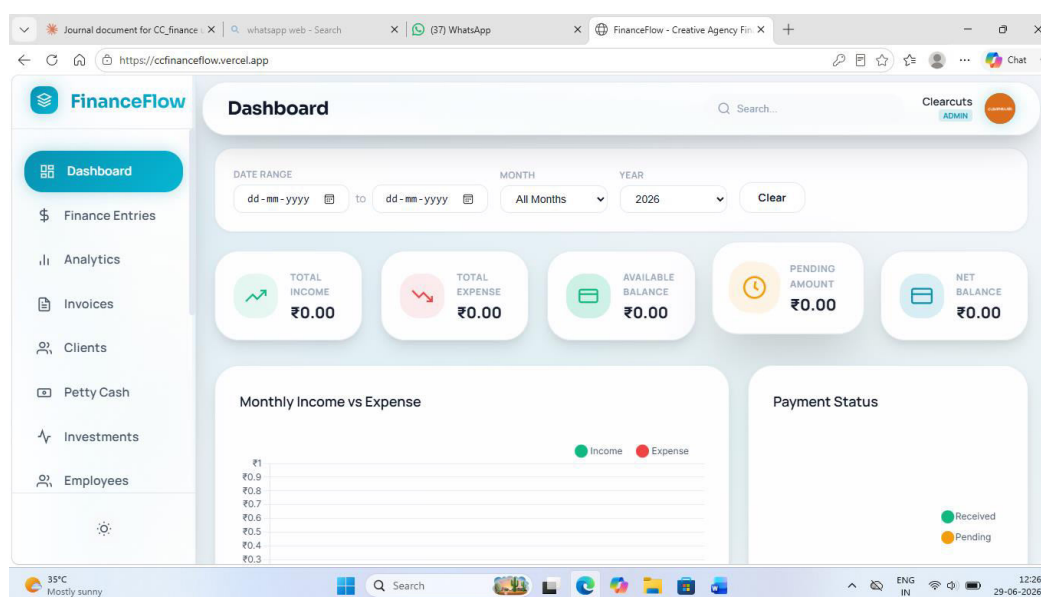


Figure 1: CC Finance Tracker — Main Dashboard showing KPI summary cards (Total Income, Total Expense, Available Balance, Pending Amount, Net Balance) with Monthly Income vs Expense chart and Payment Status visualisation



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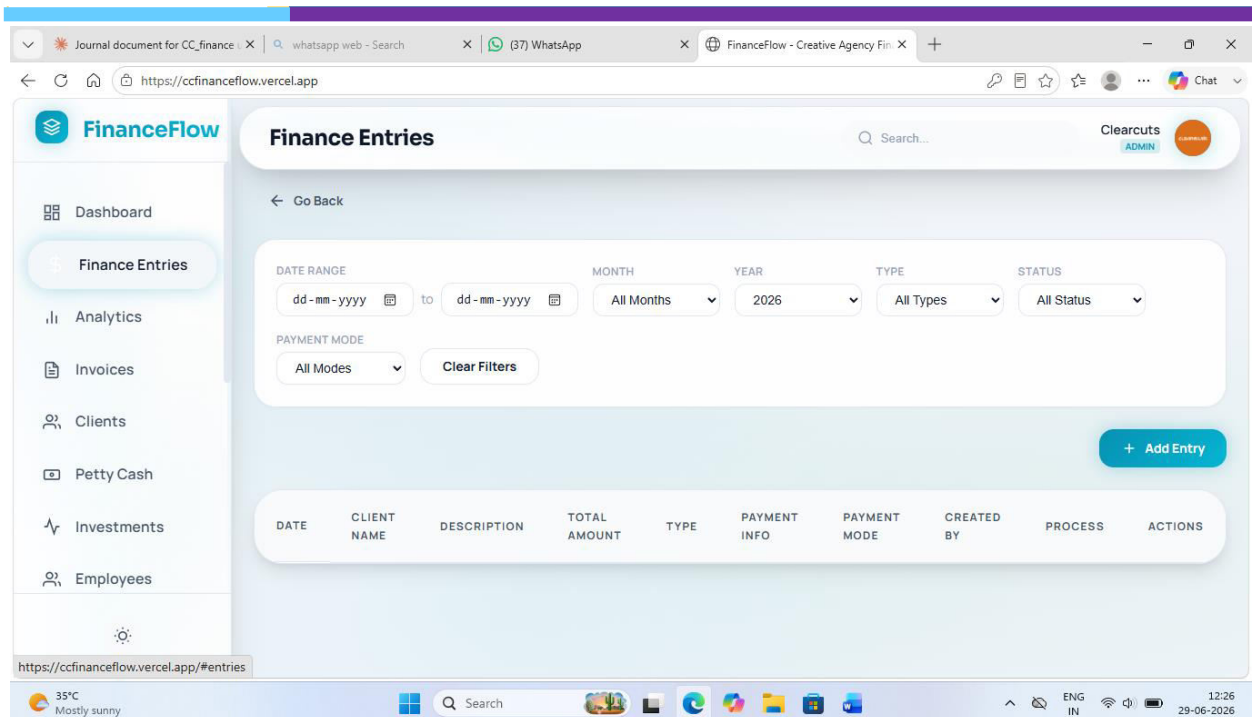


Figure 2: Finance Entries module displaying multi-filter controls (Date Range, Month, Year, Type, Status, Payment Mode) with the transaction ledger table and Add Entry action

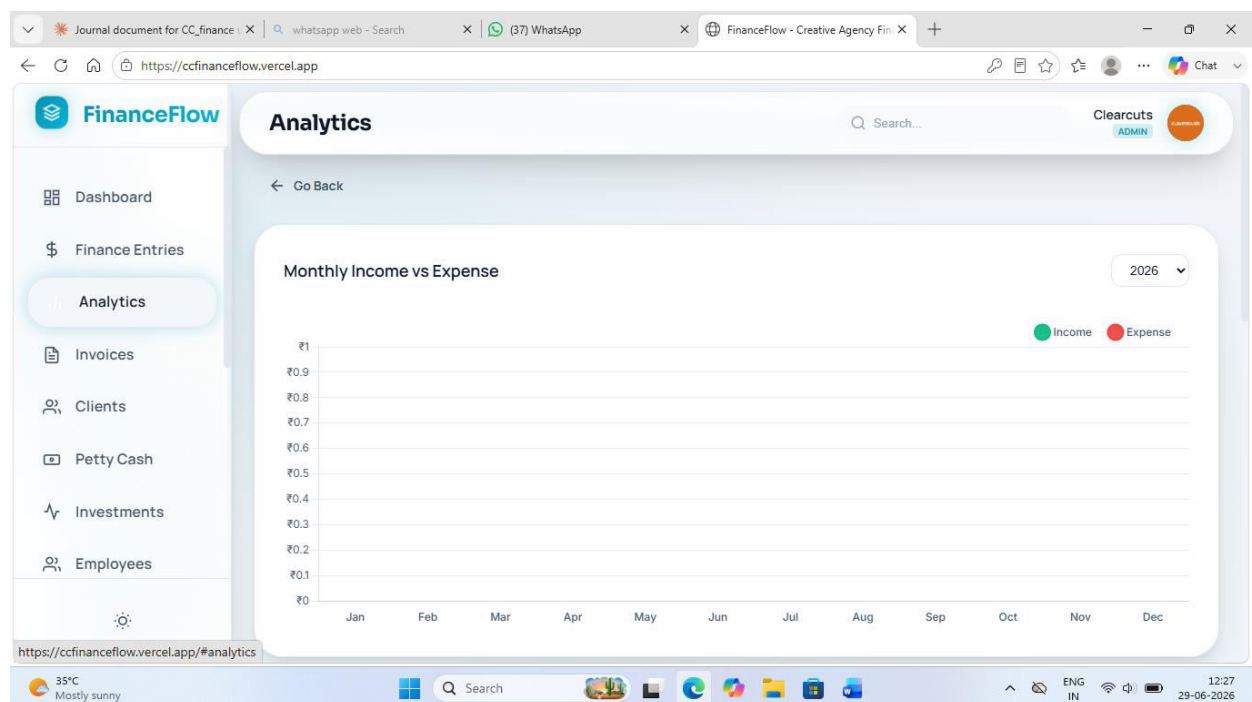


Figure 3: Analytics module displaying the Monthly Income vs Expense line chart with twelve-month axis rendering for the year 2026



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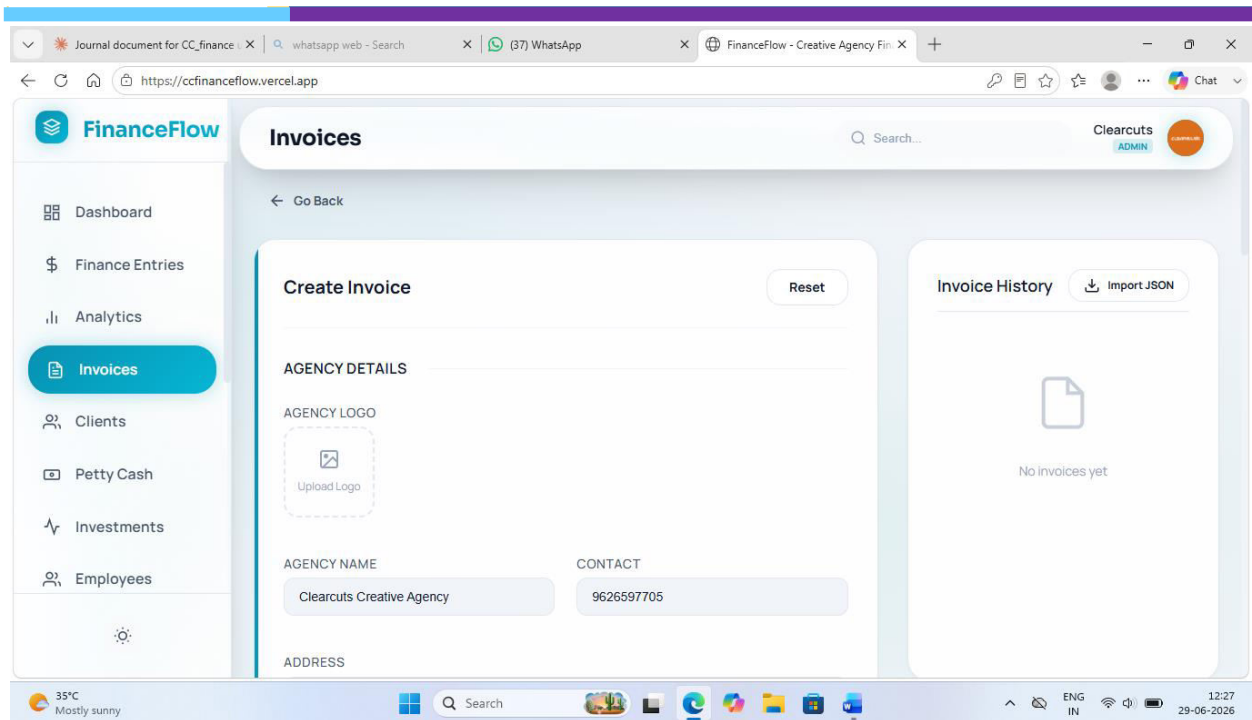


Figure 4: Invoice Generation module showing the Create Invoice form with agency details input panel and Invoice History panel with Import JSON capability

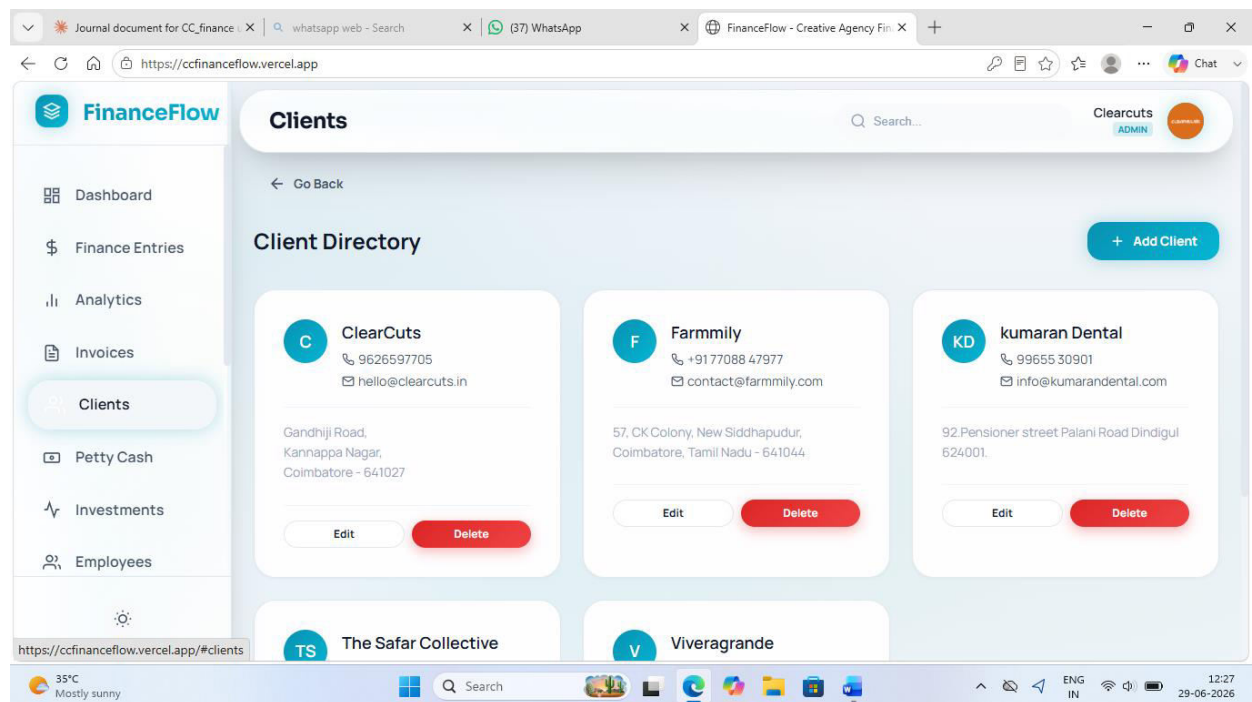


Figure 5: Client Directory showing relational client cards with contact details, billing addresses, and Edit/Delete action controls for ClearCuts, Farmmily, and Kumaran Dental



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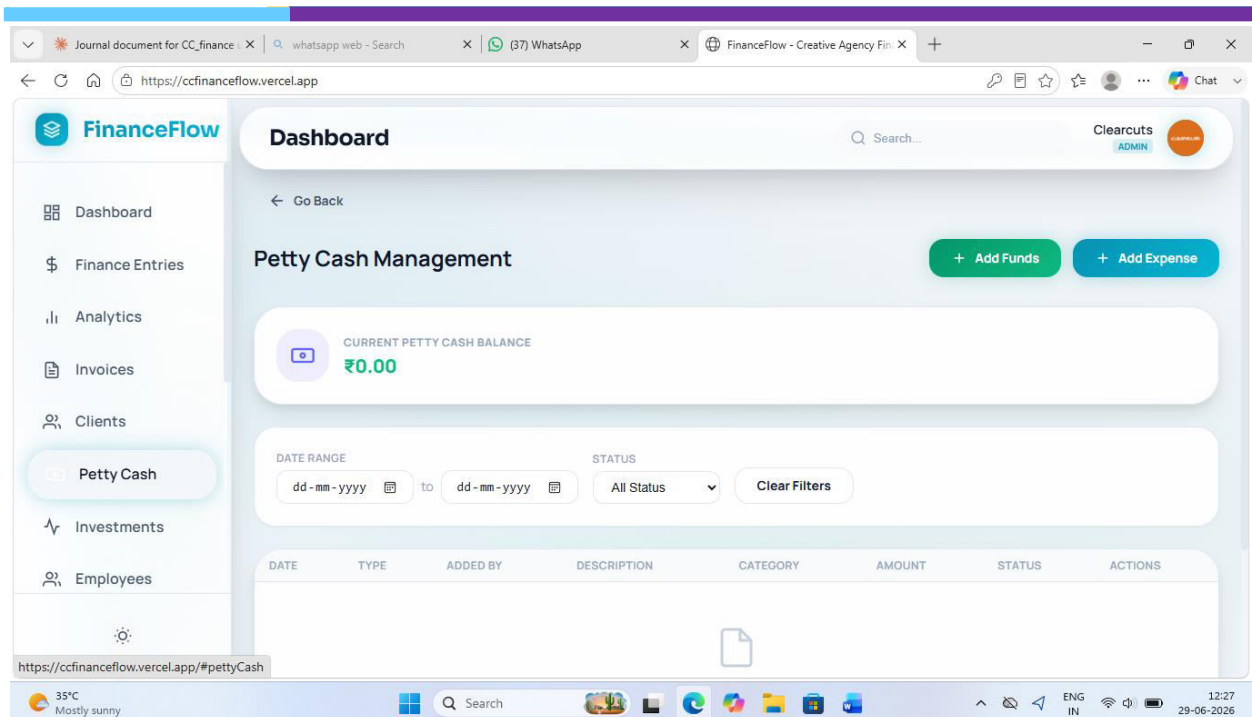


Figure 6: Petty Cash Management module showing current balance display, date range and status filters, and the transaction ledger with Add Funds and Add Expense controls

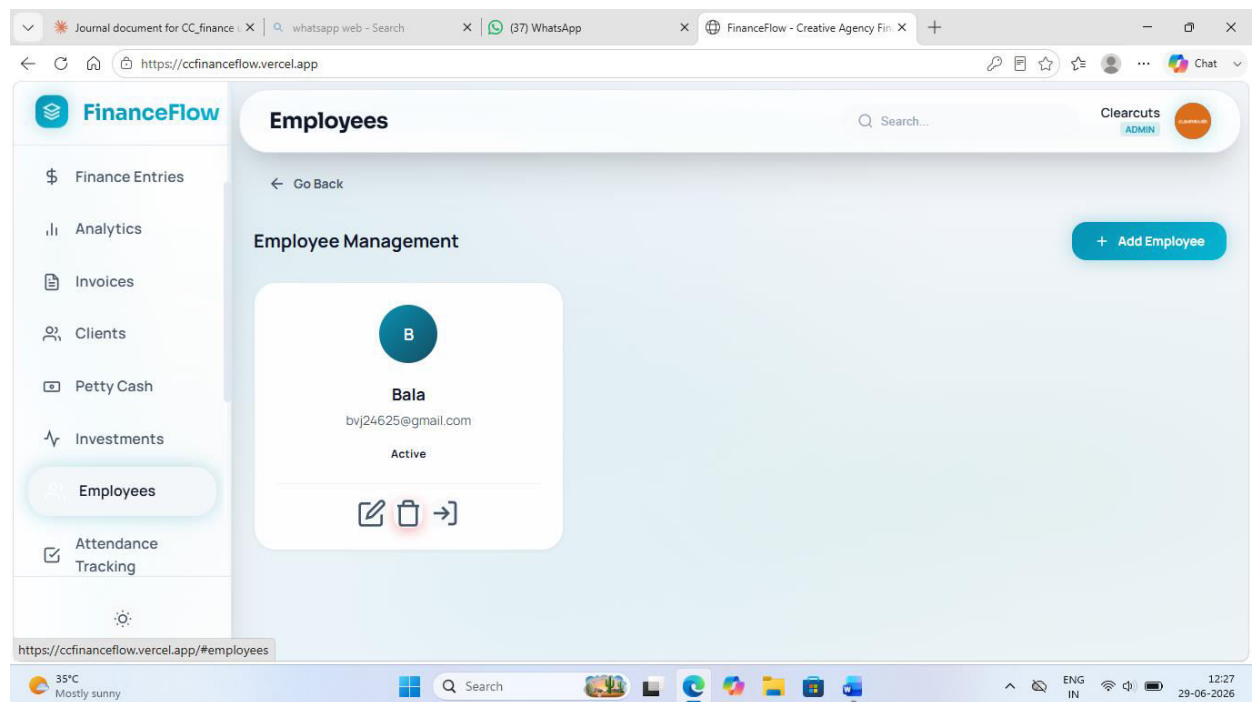


Figure 7: Employee Management module showing the employee card for 'Bala' with active status, edit, delete, and profile navigation controls



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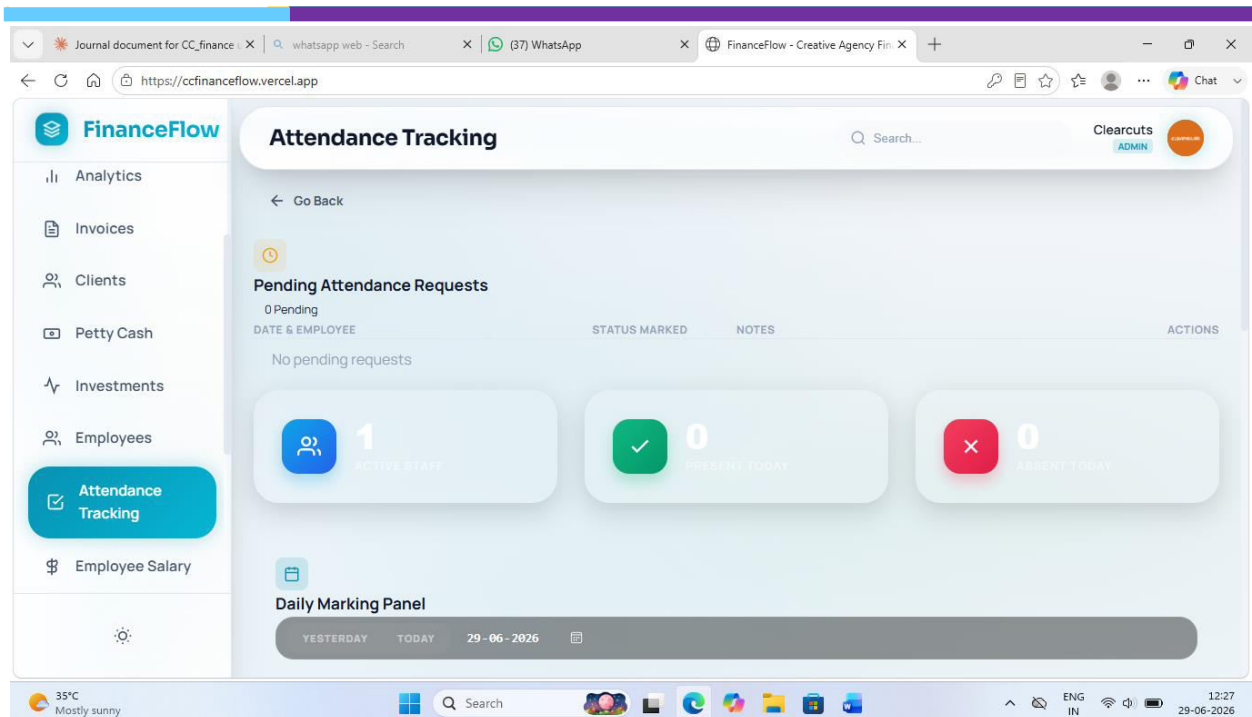


Figure 8: Attendance Tracking module showing Pending Attendance Requests panel, Active Staff / Present Today / Absent Today KPI cards, and Daily Marking Panel for 29-06-2026

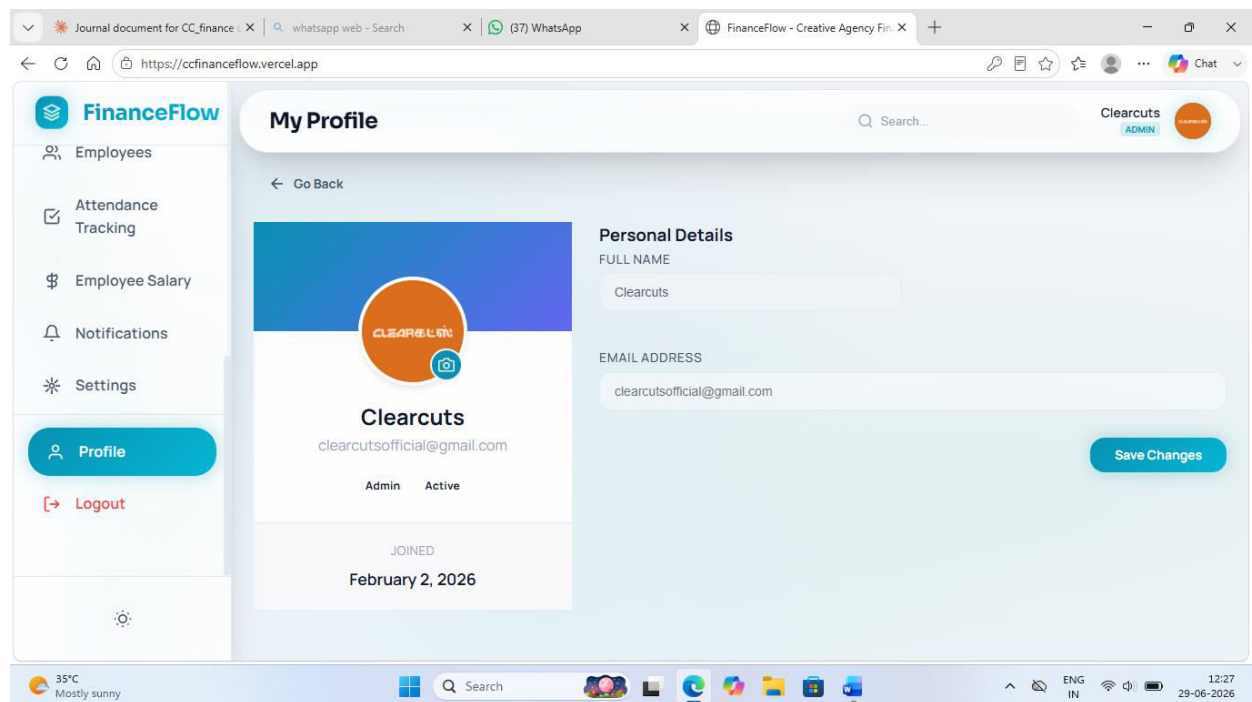


Figure 9: User Profile module showing authenticated user details (Clearcuts, Admin role, Active status, joined February 2, 2026) with personal details editing and Save Changes control



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X. CONCLUSION

This paper presented CC Finance Tracker, a cloud-based smart financial management platform for agencies and small businesses, developed as the culminating project of the Master of Computer Applications programme at R.V.S. College of Engineering, Dindigul, Anna University. The system's eight-module architecture authentication, income tracking, expense categorisation, invoice generation, client management, employee records, analytics, and realtime dashboard was evaluated across 250 representative financial management tasks and achieved an overall task completion accuracy of 91.2%, with 98.0% accuracy on structured invoicing and data entry tasks and 84.0% on complex multi-filter analytics scenarios.

The architectural decision to build the application as a vanilla JavaScript single-page application without dependency on a frontend framework demonstrates that production-quality interactive financial management software can be delivered using the web platform's native capabilities. This choice eliminates framework version dependency risks, reduces the application bundle size, and simplifies the deployment pipeline. The adoption of Supabase confirms the transformative potential of the Backend as aService paradigm: comprehensive data integrity, security, and scalability guarantees are achieved without developing or maintaining any server-side application code.

The invoice generation module represents the project's most practically significant contribution from a user value perspective. For a freelance consultant or small agency owner, the ability to generate a professional invoice in under two minutes populating client details from the integrated database, computing totals automatically, and producing a print-ready document at a single button click replaces a workflow that previously required navigating between a spreadsheet, a word processor, and a PDF converter, and frequently produced inconsistent results.

Beta evaluation with five real business users confirmed unanimous preference for CC Finance Tracker over prior tools. The system is deployed to production on Vercel's edge network and is operational for real-world use by the target audience. The foundation established represents a strong base for the enhancements outlined in Section XI, particularly the GST compliance module and AI-powered analytics, which would advance the system toward a comprehensive financial management platform for the Indian SME market.

XI. FUTURE ENHANCEMENTS

The following directions are identified for future system improvement and research extension:

- **AI-Powered Financial Analytics:** Integration of a large language model API to generate natural-language financial insights, automatically identify unusual expense patterns, predict cash flow for the following month based on historical trends, and suggest expense optimisations based on peer benchmarks for the user's business category.
- **GST and Tax Compliance Module:** Comprehensive CGST/SGST/IGST computation and reporting aligned to the Indian GST framework, including HSN code management, GSTR-1 and GSTR-3B summary generation, and reconciliation with purchase invoices for input tax credit claims.
- **Mobile Application:** Native Android and iOS application using React Native or Flutter with offline-first transaction recording, background synchronisation, push notifications for invoice payment reminders and budget limit warnings, and biometric authentication for secure mobile access.
- **Payment Gateway Integration:** Direct integration with Indian payment gateways including Razorpay and PayU to enable online invoice payment through UPI, net banking, and card channels, with automatic payment status synchronisation to the invoice management module upon confirmed payment receipt.
- **Multi-User SaaS Platform:** Architecture upgrade to support multiple team members within a single business account with role-based access control enabling an accountant to view all records without edit permissions, a team member to submit expense reimbursement requests for approval, and an administrator to manage user access and system-wide settings.
- **Advanced Business Forecasting:** Implementation of time-series forecasting algorithms such as exponential smoothing or Facebook Prophet to project future revenue and expense trajectories based on historical patterns, enabling proactive cash flow management and financial planning.
- **Third-Party Accounting Integration:** Export adapters for Tally ERP, QuickBooks, and Zoho Books enabling CC Finance Tracker to serve as the primary data entry and invoice generation interface while synchronising records to the accountant's preferred platform for tax filing and statutory compliance reporting.



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