

2. INTRODUCTION

Python-based monthly expense tracker

Combines expense management with predictive analytics
Uses only Python standard library for maximum compatibility

3. PROBLEM STATEMENT

Manual expense tracking is inefficient and error-prone

Lack of spending insights and future forecasting

Need for automated financial management tools

4. FUNCTIONAL REQUIREMENTS

User authentication and session management

Complete CRUD operations for expenses

Expense categorization system

Future expense predictions (3-month forecast)

Text-based data visualization

Expense statistics and reporting

5. NON-FUNCTIONAL REQUIREMENTS

Security: Password hashing, user data isolation

Reliability: 99% uptime, data persistence

Performance: Sub-second response for all operations

Usability: Intuitive CLI interface

Maintainability: Modular, documented code

6. SYSTEM ARCHITECTURE

CLI Interface → Application Layer → Business Logic → Data Storage ↓ (Main App) (CRUD, ML)
(JSON Files)

UserInput PredictionEngine Visualization

7. DESIGN DIAGRAMS

Use Case Diagram

User → [Login] → [Manage Expenses] → [View Reports] → [Get Predictions]

Workflow Diagram

Start → Login → Main Menu → Select Feature → Process → Display → Loop

Sequence Diagram

User → App: Login

App → Auth: Verify

App → ExpenseMgr: CRUD Operations App → Predictor: Generate Forecast App → Visualizer:
Create Reports

Class Diagram

```
MonthlyExpensesApp (main) ┊— AuthenticationManager ┊— ExpenseManager  
    ┊— ExpensePredictor  
    └— ExpenseVisualizer
```

ER Diagram

Users (username, password_hash)
Expenses (id, user_id, amount, category, date, description)

8. DESIGN DECISIONS & RATIONALE

Used JSON storage for simplicity and no database dependency Implemented moving average algorithm for lightweight predictions Chose CLI interface for broad compatibility Used standard library only for zero dependencies

9. IMPLEMENTATION DETAILS

500+ lines of Python code
5 main classes with single responsibility principle PBKDF2 password hashing for security
UUID-based expense identification
Comprehensive error handling

10. SCREENSHOTS / RESULTS

Clean menu-driven interface
Formatted expense tables with totals
Text-based bar charts for categories
Prediction reports with confidence scores
Statistical summaries

11. TESTING APPROACH

Manual testing of all user flows
Boundary value testing for inputs
Error scenario testing
Data persistence verification
Cross-user data isolation testing

12. CHALLENGES FACED

Implementing ML predictions without external libraries Data persistence issues in initial versions

User interface design for CLI

Balancing simplicity with feature richness

13. LEARNINGS & KEY TAKEAWAYS

Importance of modular architecture

Security best practices for authentication

Effective text-based visualization techniques

Trade-offs in algorithm selection for constrained environments

14. FUTURE ENHANCEMENTS

Web-based GUI interface

Advanced ML models with scikit-learn

Database integration (SQLite/PostgreSQL)

Expense budgeting and alerts

Data export (CSV/PDF reports)

Multi-currency support

15. REFERENCES

Python Standard Library Documentation

PBKDF2 RFC 2898

JSON Schema Specification

Software Architecture Patterns