Version: 1.0

ClariFi

Architecture/Design Document

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Change History

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Description of Change: Final draft

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1 Introduction

This document describes the architecture and design for the ClariFi application being developed for Commerce Bank in partnership with the University of Missouri – Kansas City (UMKC). ClariFi is a web application that allows users to set financial goals and easily track them all in one spot. The application will have LLM integration that will assist users in answering any questions the user may have. ClariFi offers a simple, yet bold user interface so users are easily able to use and navigate the website.

The purpose of this document is to describe the architecture and design of the ClariFi application in a way that addresses the interests and concerns of all major stakeholders. For this application the major stakeholders are:

- Users and the customer – they want assurances that the architecture will provide system functionality and exhibit desirable non-functional quality requirements such as usability, reliability, etc.
- Developers – they want an architecture that will minimize complexity and development effort.
- Project Manager – the project manager is responsible for assigning tasks and coordinating development work. He wants an architecture that divides the system into components of roughly equal size and complexity that can be developed simultaneously with minimal dependencies. For this to happen, the modules need well-defined interfaces. Also, because most individuals specialize in a particular skill or technology, or have interest in certain technologies, modules should be designed around specific expertise/interests. For example, all UI logic might be encapsulated in one module. Another might have all logic related to financial management tasks

The architecture and design for a software system are complex, and individual stakeholders often have specialized interests. There is not one diagram or model that can easily express a system's architecture and design. For this reason, software architecture and design is often presented in terms of multiple views or perspectives [IEEE Std. 1471]. Here the architecture of the ClariFi application is described from 4 different perspectives [1995 Krutchen]:

1. Logical View – major components, attributes and operations. This view also includes relationships between components and their interactions. When doing OO design, class diagrams and sequence diagrams are often used to express the logical view.
2. Process View – the threads of control and processes used to execute the operations identified in the logical view.
3. Development View – how system modules map to development organization.
4. Use Case View – the use case view is used to both motivate and validate design activity. At the start of design the requirements define the functional objectives for the design. Use cases are also used to validate suggested designs. It should be possible to walk through a use case scenario and follow the interaction between

high-level components. The components should have all the necessary behavior to conceptually execute a use case.

2 Design Goals

There is no absolute measure for distinguishing between good and bad design. The value of a design depends on stakeholder priorities. For example, depending on the circumstances, an efficient design might be better than a maintainable one, or vise versa. Therefore, before presenting a design it is good practice to state the design priorities. The design that is offered will be judged according to how well it satisfies the stated priorities.

The priorities for the design that follows are:

- **The design should allow for additional feature in the future (ex: different AI models or visualization tools) without much rework**
- **Maintain a separation of convers**
- **UI, backend logic, AI processing, data storage, and visualization should be well-defined so that changes made to one area do not affect other parts of the process**
- **Design should be easy to implement and maintain, this will ensure faster development**
- **Allow for reuse wherever possible**

3 System Behavior

The use case view is used to both drive the design phase and validate the output of the design phase. The architecture description presented here starts with a review of the expect system behavior in order to set the stage for the architecture description that follows. For a more detailed account of software requirements, see the requirements document

- **User Registration/Authentication**: Users create accounts and log in securely
- **Goal Setting**: Users define financial goals with target amounts and deadlines
- **Goal Tracking**: Users input transactions and monitor progress toward goals
- **AI Chatbot Interaction**: Users ask financial questions and receive AI-powered responses
- **Data Visualization**: Users view charts/dashboards showing financial progress
- **Profile Management**: Users update personal and financial information

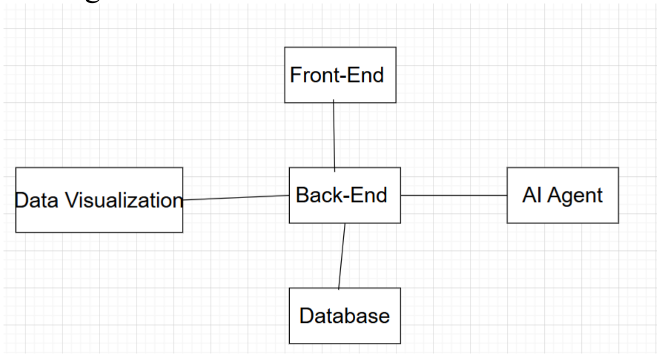
4 Logical View

The logical view describes the main functional components of the system. This includes modules, the static relationships between modules, and their dynamic patterns of interaction.

In this section the modules of the system are first expressed in terms of high level components (architecture) and progressively refined into more detailed components and eventually classes with specific attributes and operations.

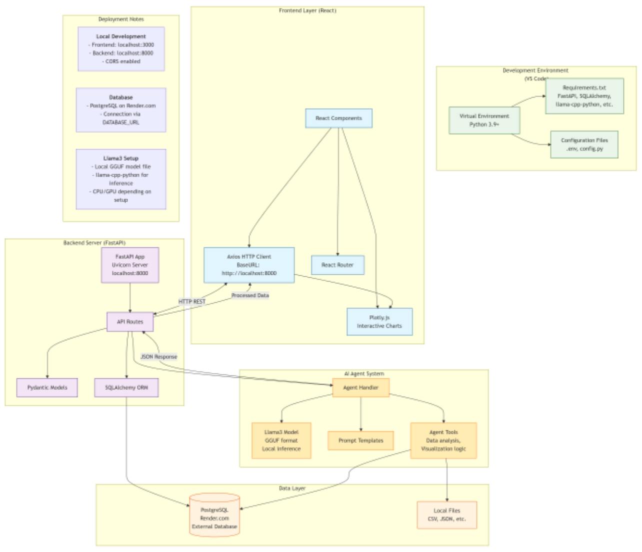
4.1 High-Level Design (Architecture)

The high-level view or architecture consists of 5 major components:

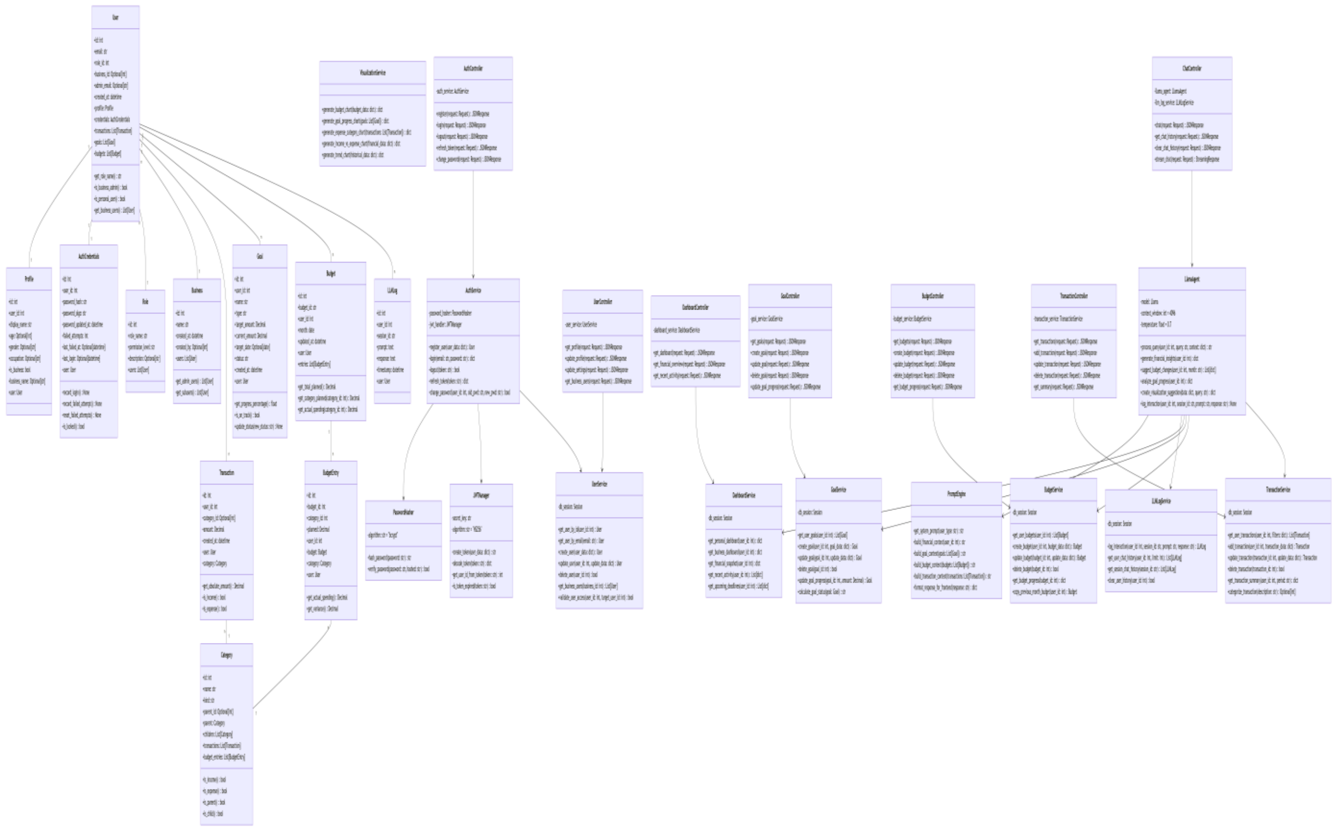


- The **frontend** will be responsible for the visual aspect of the app, providing all user interactions. It can collect user input such as text and display things like tables, charts or dashboards.
- The **backend** will be receive request from the frontend, validate and process the user input and data and handel the connections between AI agent and database. Additionally it will also log the inputs and outputs into the database while formatting the visualization results.
- The **database** will store the user profile which would include name, email, phone number, along with financial information for each user
- The **AI Agent** will take in user input on the chatbot page then work within the agent hierarchy to deliver the user's desired results
- The **data visualization** tool will work in collaboration with the AI agent to ensure that the user is given their requested visual

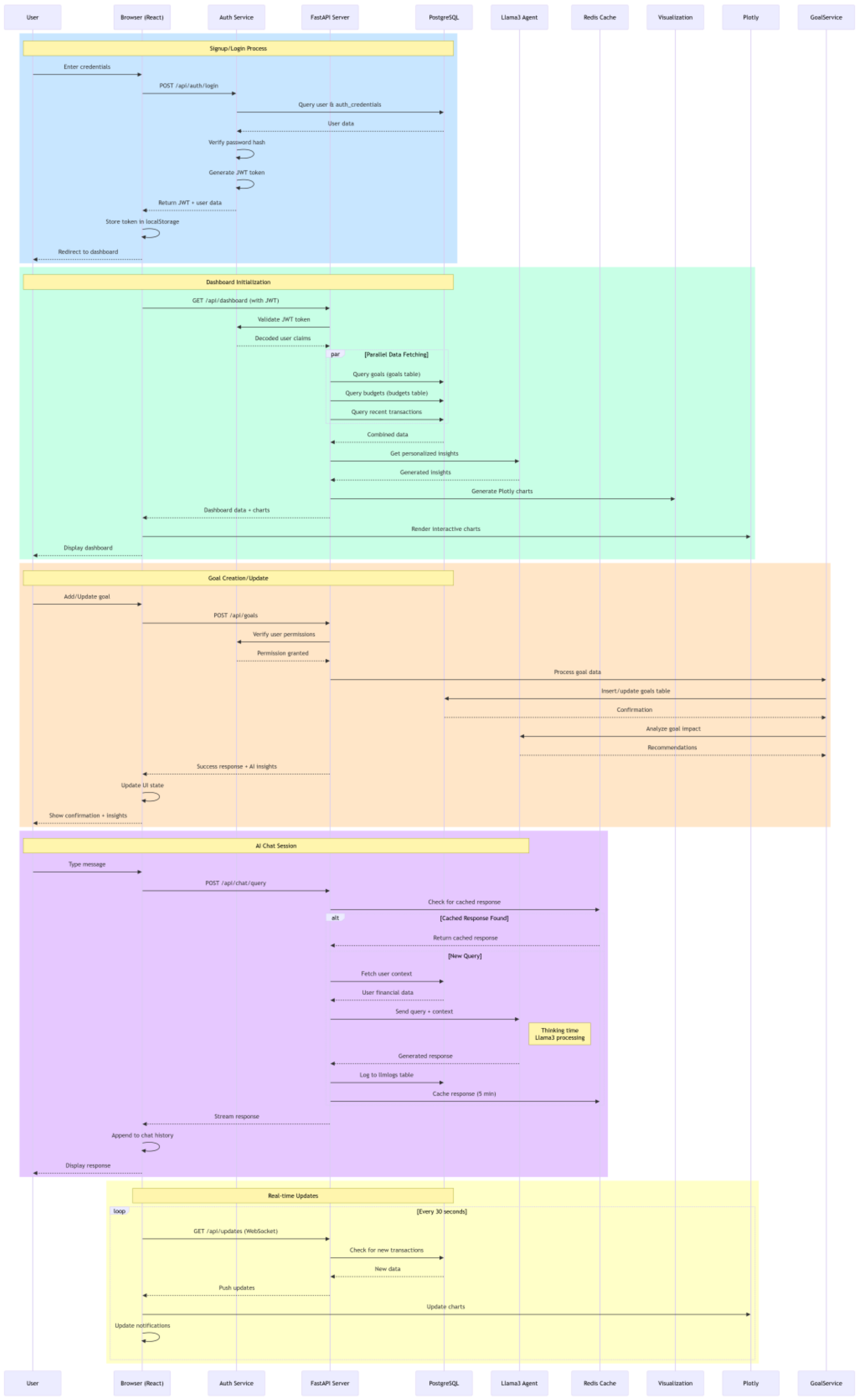
4.2 Mid-Level Design


Deployment Notes
Local Development
- Frontend: localhost:3000
- Backend: localhost:8000
- CORS enabled
Database
- PostgreSQL on Render.com
- Connection via DATABASE_URL
Llama3 Setup
- Local GGUF model file
- llama-cpp-python for inference
- CPU/GPU depending on setup
Frontend Layer (React)
React Components
Axios HTTP Client BaseURL: http://localhost:8000
React Router
Plotly.js Interactive Charts
Development Environment (VS Code)
Virtual Environment Python 3.9+
Requirements.txt FastAPI, SQLAlchemy, llama-cpp-python, etc.
Configuration Files .env, config.py
Backend Server (FastAPI)
FastAPI App Uvicorn Server localhost:8000
API Routes
HTTP REST
Processed Data
JSON Response
Pydantic Models
SQLAlchemy ORM
AI Agent System
Agent Handler
Llama3 Model GGUF format Local inference
Prompt Templates
Agent Tools Data analysis, Visualization logic
Data Layer
PostgreSQL Render.com External Database
Local Files CSV, JSON, etc.

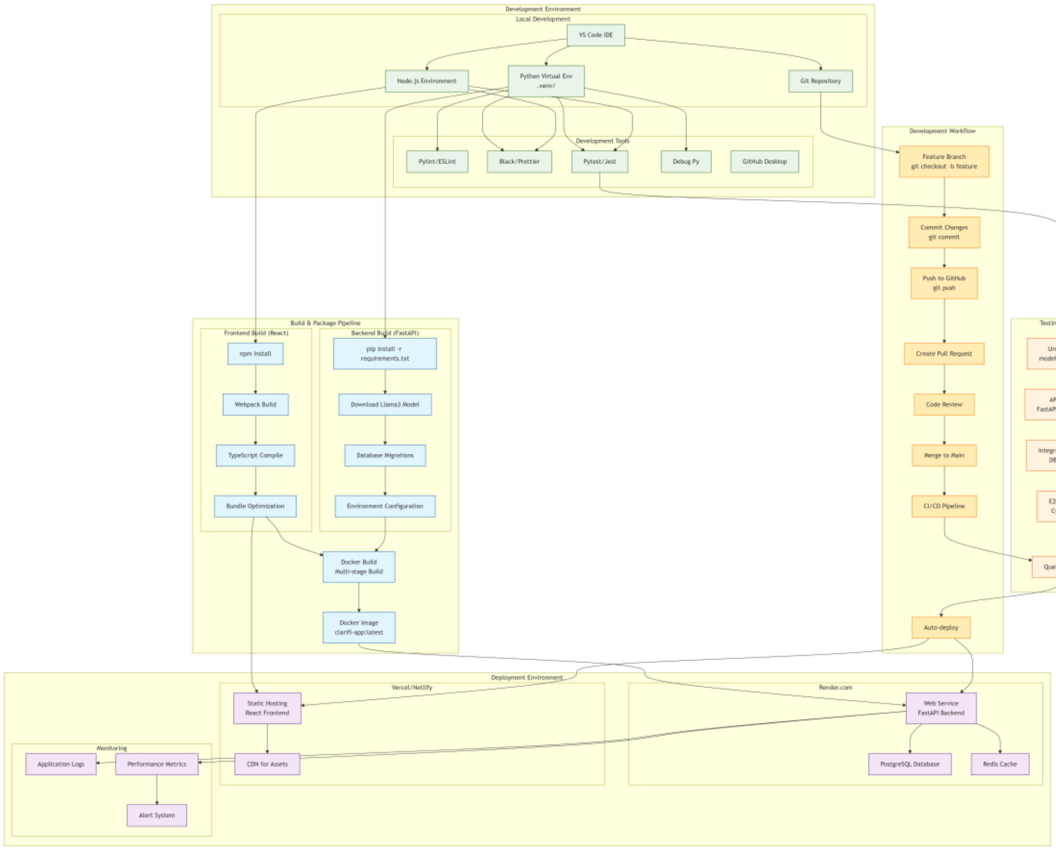
4.3 Detailed Class Design

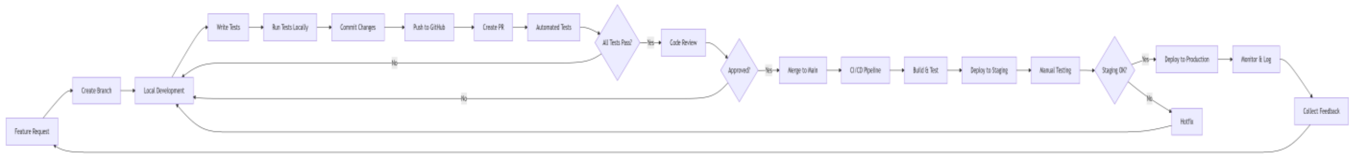


5 Process View

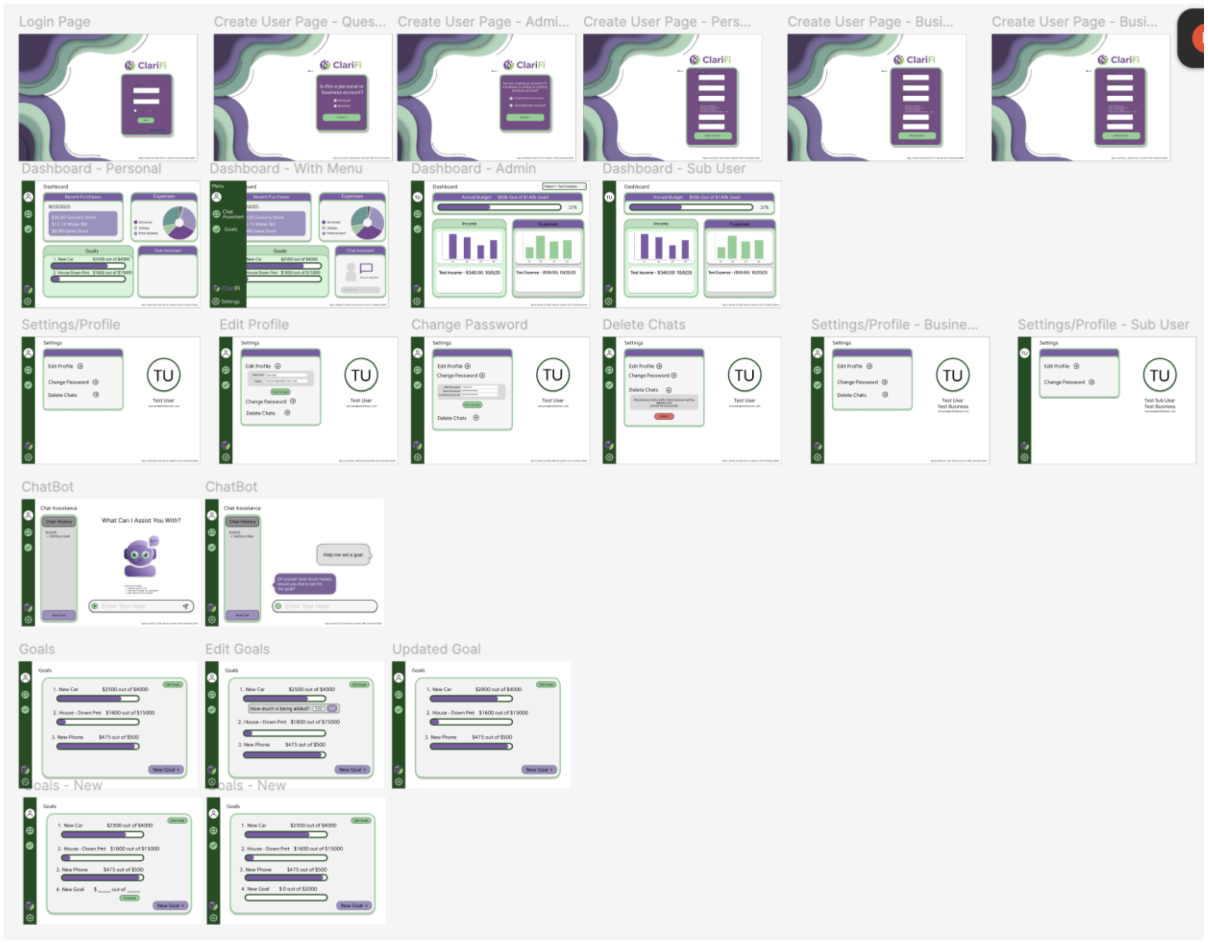

User
Browser (React)
Auth Service
FastAPI Server
PostgreSQL
Llama3 Agent
Redis Cache
Visualization
Plotly
GoalService
Signup/Login Process
Enter credentials
POST /api/auth/login
Query user & auth_credentials
User data
Verify password hash
Generate JWT token
Return JWT + user data
Store token in localStorage
Redirect to dashboard
Dashboard Initialization
GET /api/dashboard (with JWT)
Validate JWT token
Decoded user claims
par
[Parallel Data Fetching]
Query goals (goals table)
Query budgets (budgets table)
Query recent transactions
Combined data
Get personalized insights
Generated insights
Generate Plotly charts
Dashboard data + charts
Render interactive charts
Display dashboard
Goal Creation/Update
Add/Update goal
POST /api/goals
Verify user permissions
Permission granted
Process goal data
Insert/update goals table
Confirmation
Analyze goal impact
Recommendations
Success response + AI insights
Update UI state
Show confirmation + insights
AI Chat Session
Type message
POST /api/chat/query
Check for cached response
alt
[Cached Response Found]
Return cached response
[New Query]
Fetch user context
User financial data
Send query + context
Thinking time
Llama3 processing
Generated response
Log to llmlogs table
Cache response (5 min)
Stream response
Append to chat history
Display response
Real-time Updates
loop
[Every 30 seconds]
GET /api/updates (WebSocket)
Check for new transactions
New data
Push updates
Update charts
Update notifications
User
Browser (React)
Auth Service
FastAPI Server
PostgreSQL
Llama3 Agent
Redis Cache
Visualization
Plotly
GoalService

6 Development View





7 Physical View



8 Use Case View

Basic Tour:

1. User starts at the login page & either
   a. they click sign up and create an account and go q1 if personal and q2 if business / subuser
   b. Or they login with a valid email and password
2. Based on the type of user -> you are greeted with a different version of the app
3. User taken to dashboard page (all users)
4. Can navigate to the goals page (personal and business users)
   a. View goals
   b. Add goals
   c. Update goals
5. Can navigate to the chatbot page (personal and business users)
   a. Look at previous chat history
   b. Start a new conversation with the chat bot (powered w/ llama3)
      i. Prompt -> thinks for some time -> LLM generated response
6. Can navigate to the settings page (all users)
   a. Update password
   b. Update name
   c. Update business name (business user)
7. Click the logout button to logout and clear session (all users)