Low-Level Architecture and Data Models

03:Autonomous Trading Bot

Student ID	Name
23100011	Suleman Mahmood
23100197	Ahmed Tahir Shekhani
23100198	Ali Asghar
23100176	Syed Talal Hasan
23110345	Muhammad Ammar Ibrahim

Table of Contents

1. Introduction

A web application with an autonomous trading bot instance that will trade to generate profitable returns on stocks. The bot will be trained on the PSX data. The bot's decision will be based on the concepts of game theory, mathematical models, financial techniques, and especially artificial intelligence. The primary web app will allow the user to provide the bot's configuration, which includes, target return, risk appetite, and duration of the instance.

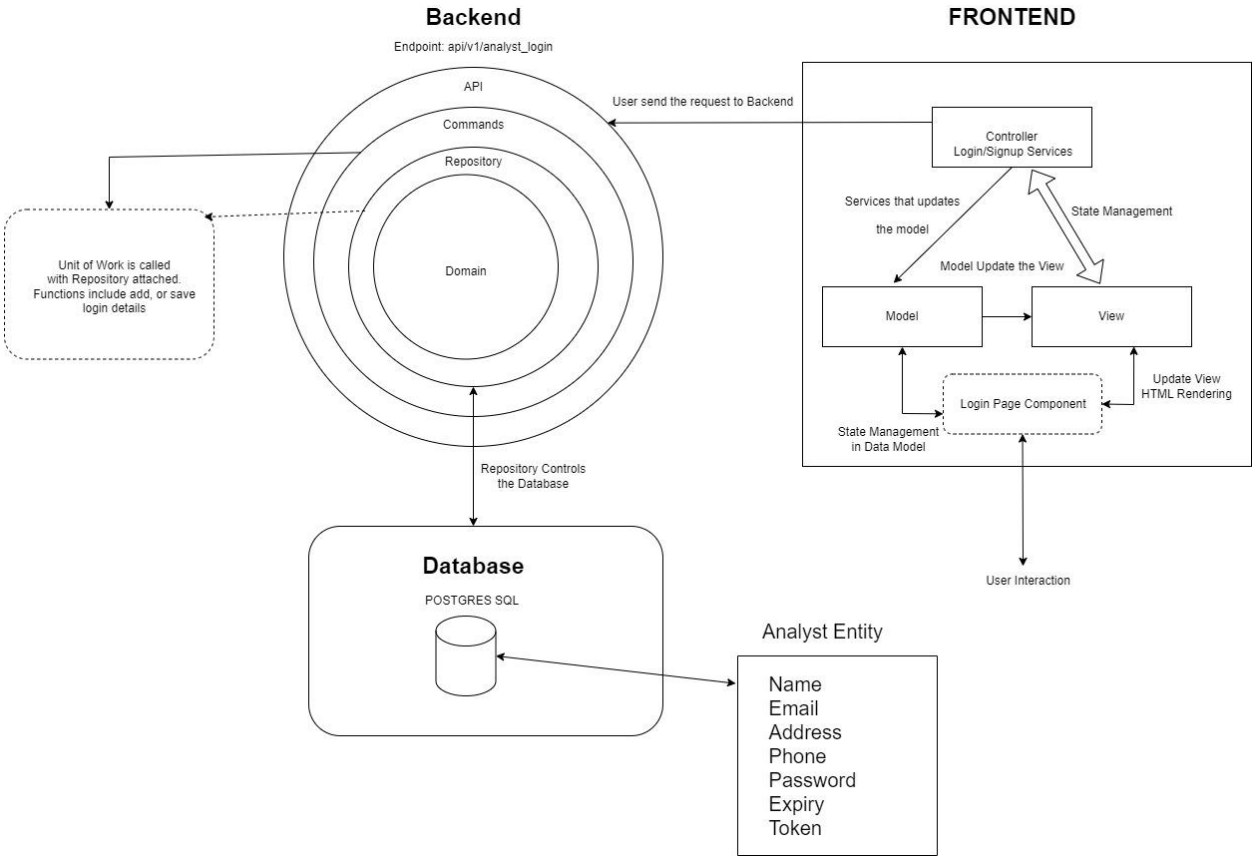
With recent advancements in deep learning frameworks and access to faster gpus, training complex models that can predict on time series data has opened new avenues to explore stock market trading. We plan on using models that have a memory component in them, such as LSTM (Long Short Term Memory) to make predictions and trades on the stock market.

The overall objective for the application would be to achieve the return target provided by the analyst while configuring the bot and minimize loss according to the risk factor provided. The potential users of this application would be trade analysts or managers who will use the bot to run its instances according to their requirements. The investors will use it to view their reports of the investments. They can filter the data according to the date ranges as well.

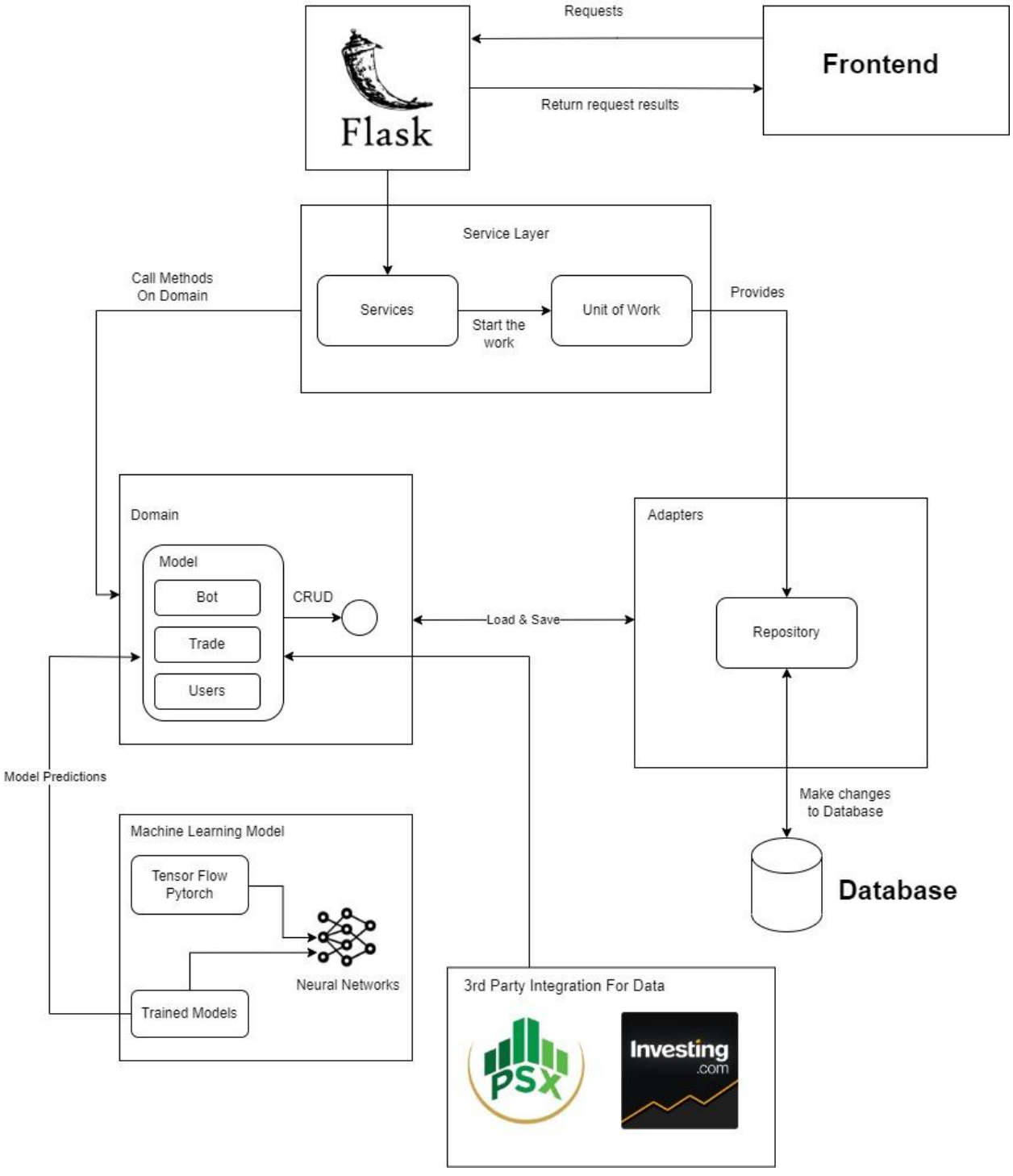
Technical details:
The project's tech stack would be Next.js for frontend web application, Flask for backend server, and PostgreSQL for our persistent storage. The application would follow three-tier architecture with a repository pattern for the persistent layer, models, and command layer for modifying the state.

2. System Architecture

2.1 Architecture Diagram—As it is in the prototype code



Backend Architecture based on Domain Driven Design



User sends a request to the login page component that updates the model and the view. The request is made to the controller that hosts the login/signup service. This request is sent to the flask API. Login page component has Data Model managed in state which renders the view when an update is triggered in data model. For example, in login we have data request of Email and Password along with the analyst or investor role stored in state. As user interacts the view and provide the details, email password and role are shared to model and passed to controller. In services there is loginAuth function which takes the data and make a call to api with axios.post on endpoint /api/v1/analyst_login and waits for the result. This api calls the command with Analyst Unitofwork which attach itself to AnalystRepo. This Repo loads AnalystClass domain with function of Login and pass the database results along with the user provided email and password. Domain function of "login" use hash to compare password and email and return true if success. The model is updated on backend and data gets return from api. On retrieving success message the controlled renders dashboard view and the user gets the access dashboard functionality now.

2.2 Architecture Diagram—As it should-be

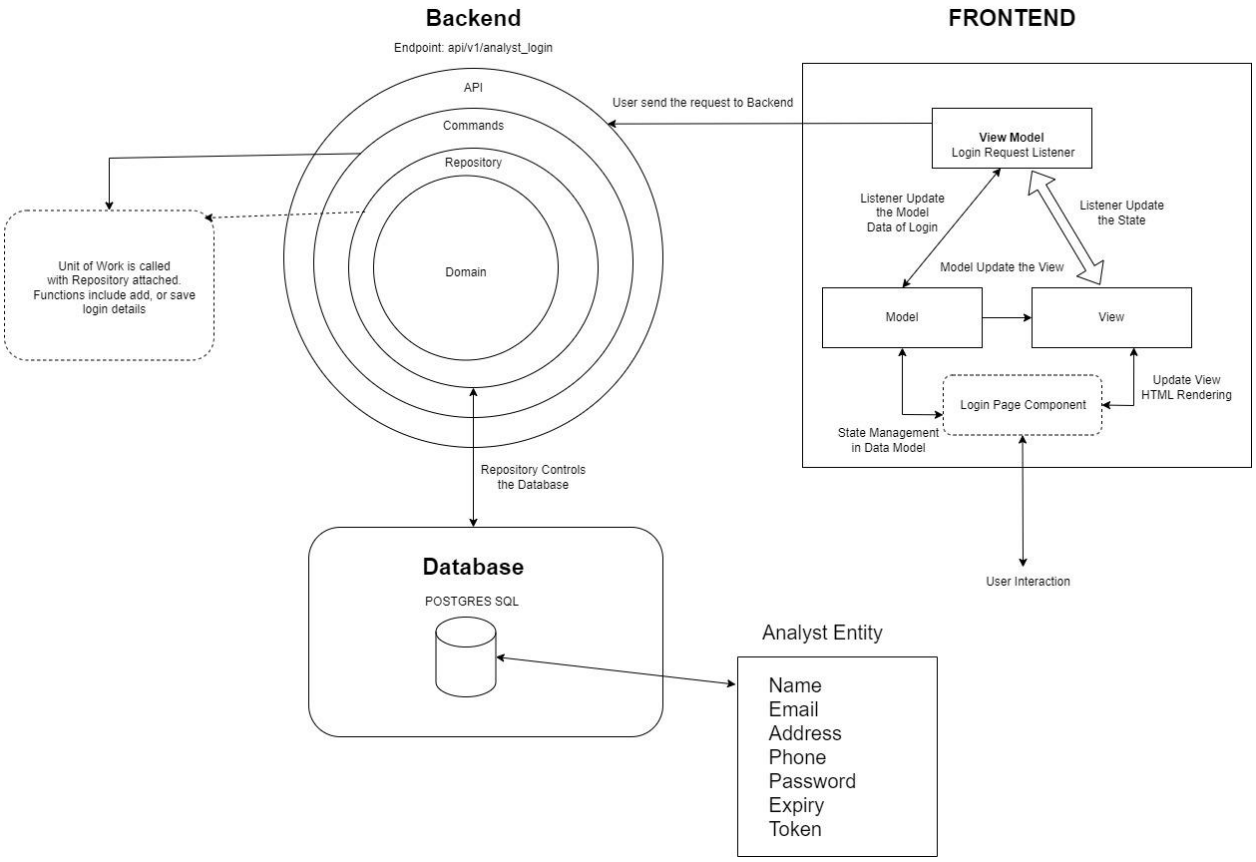
In a couple of paragraphs, discuss how your updated architecture will help in achieving design goals listed above.

As the MVVM model will allow for the separation of components in each layer, we can test them separately. This allows for the code base to be easily tested if new components are added and integrated.

It is reusable as if we change the underlying View Model to just a controller the components of the view and model don't have to be changed. We can reuse them in the updated architecture as needed. It also allows these components to be incorporated in the extension of the code if we add new features.

As the model is separate the data management and the front end logic can be extended here. The view model can manage multiple instances of the model along with event listeners which makes it scalable as we can add other instances on the existing ones.

As the model view is the bridge between the model and the view, each class has different concerns that it can call. The bot class cannot interact with the login/signup logic nor vice versa. These implementations are kept hidden from separate concerns in the MVVM architecture.



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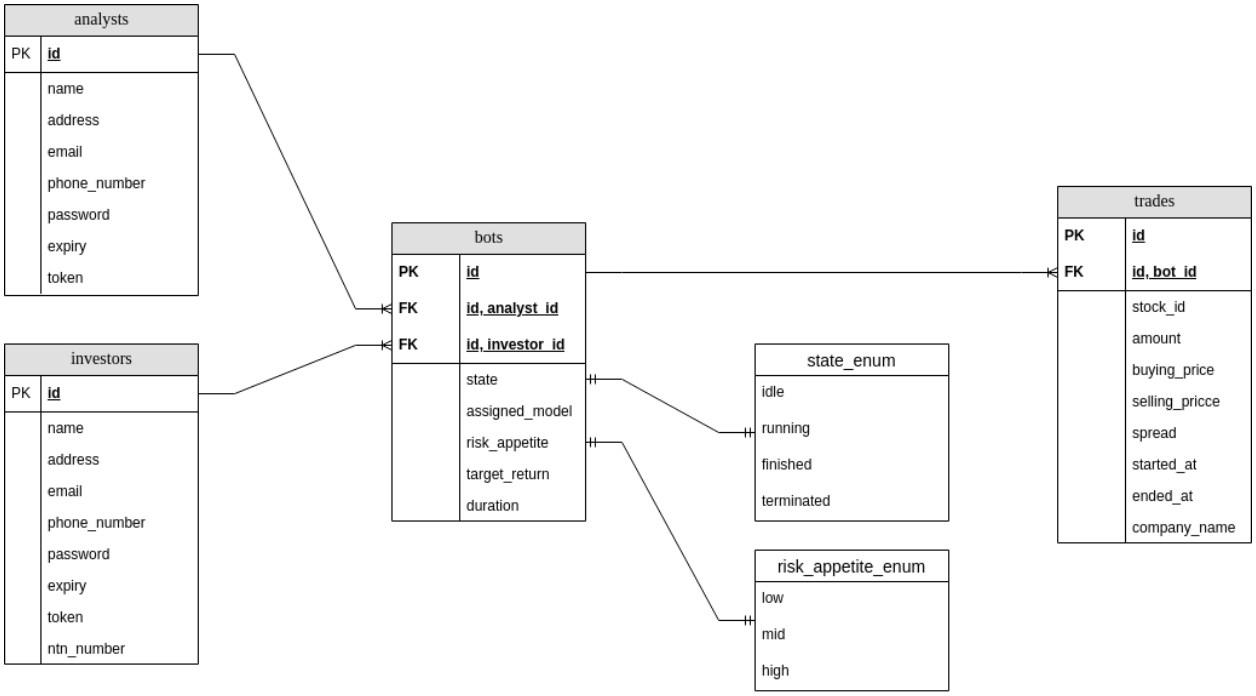
3. Data Models

Entities:
Analyst: Analysts will register investors, configure and start the execution of the bot, analyze its statistics and assign investors to their bots.

Analyst: Investors will use the bot for investment purposes and can view a summary report of the performance of the bot for a specific range of time period (monthly, quarterly, half-yearly, yearly, or other combinations of days or months).

Bot: The bot will be trained on the PSX data. The bot's decision will be based on the concepts of game theory, mathematical models, financial techniques, and especially artificial intelligence. The primary web app will allow the user to provide the bot's configuration, which includes, target return, risk appetite, and duration of the instance.



4. Tools and Technologies

Frontend

Language

- Typescript 4.8.4
- ESLint 8.25.0

JavaScript library

- Next.js 17.0.2
- React.sj 18.2.0

CSS Framework

- Tailwind CSS 3.1.8
- DaisyUI 2.31.0

API library

- Axios 1.1.2

Deployment

- Vercel

Backend

Language

- Python 3.10.7
- PostgreSQL 15

Persistent storage

- PostgreSQL 15

Server

- Flask 2.2.2

Deployment

- Google Cloud’s App Engine flexible

Deep Learning Models:

Language

- Python 3.10.7

Frame work

- Pytorch and Tensorflow 1.12.1

Tool

- Google Colab

5. Who Did What?

Name of the Team Member	Tasks done
Suleman Mahmood	ER Diagram
Ahmed Tahir Shekhani	Architecture Diagram(2.1,2.2), Introduction, Description
Ali Asghar	Tools and Technologies, Data Models description
Syed Talal Hasan	Updated Architecture description

6. Review checklist

Before submission of this deliverable, the team must perform an internal review. Each team member will review one or more sections of the deliverable.

Section Title	Reviewer Name(s)
Architecture Diagram(2.2)	Suleman Mahmood
ER Diagram	Ahmed Tahir Shekhani
Architecture Diagram(2.1)	Ali Asghar
Tools and Technologies	Syed Talal Hasan