Robo-Advisor and Investment Portfolio Management

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Objective

● Select and integrate with market data APIs to retrieve real-time financial data, historical prices, and other relevant market information.
● Develop backend functionality to analyze user risk profiles, generate investment recommendations, and dynamically rebalance investment portfolios.
● Implement a responsive web interface that allows users to input their investment preferences, track portfolio performance, and receive notifications about recommended adjustments.
● Incorporate additional features such as tax optimization strategies, performance analytics, and goal tracking to enhance the robo-advisor platform.

Requirements

- Python Programming Language
- yfinance API
- HTML/CSS/JS
- Flask

Theory

Robo Advisor

A robo-advisor is a digital platform that provides automated, algorithm-driven financial planning and investment management services with little to no human supervision. Robo advisors typically use advanced algorithms to analyze a client's financial situation, risk tolerance, and investment goals to provide personalized investment advice and management services. They typically provide portfolio construction, rebalancing, and tax-loss harvesting services at a lower cost than traditional financial advisors.

Robo advisors have gained popularity in recent years, particularly among younger investors who are comfortable with digital platforms and prefer low-cost, automated investment management solutions. However, it's important to note that while robo-advisors can provide investment advice and management services, they may not be able to provide the same level of personalized attention and expertise as a human financial advisor.

Investment Portfolio Manager

An investment portfolio manager is a professional who is responsible for managing a portfolio of investments on behalf of investors, whether they are individual clients or institutions such as pension plans and endowments.

The primary goal of an investment portfolio manager is to maximize the returns on the portfolio while minimizing risk, by the client's investment objectives and risk tolerance. To achieve this, portfolio managers use a variety of strategies and techniques, such as asset allocation, diversification, and active management of individual investments within the portfolio.

Portfolio managers typically have extensive knowledge of financial markets, investment products, and portfolio management techniques. They may also have specialized expertise in certain areas, such as equity or fixed-income investments, or specific sectors such as technology or healthcare.

Investment portfolio managers may work for investment management firms, banks, insurance companies, or other financial institutions. Some may also work independently as consultants or advisors, providing investment management services to individual clients or institutional investors.

So, here the platform should be automated and function as an Investment Portfolio manager providing maximum returns to the client.

Types of Investments

Stocks

Stocks, also known as equities, represent ownership in a company. When you buy a stock, you become a shareholder in the company and are entitled to a portion of the company's profits and assets. Stocks are traded on stock exchanges and their prices can be influenced by a variety of factors such as company earnings, economic indicators, and market sentiment. Stock prices can be volatile and can rise or fall quickly.
In general, stocks have historically provided the highest long-term returns among the investments you mentioned. However, they also come with higher risk and volatility compared to bonds or other fixed-income investments. This means that stocks have the potential for greater returns, but also greater losses.

Bonds

Bonds are debt securities issued by companies, governments, or other organizations to raise capital. When you buy a bond, you are essentially lending money to the issuer in exchange for regular interest payments and the return of your principal when the bond matures. Bonds are typically less risky than stocks and can provide a stable source of income for investors. The

value of a bond can be affected by changes in interest rates, credit ratings, and the financial health of the issuer.
Bonds typically offer lower returns than stocks but are considered less risky. Bonds also tend to have lower volatility than stocks, meaning that their prices are less likely to fluctuate dramatically in the short term.

ETFs

Exchange-traded funds (ETFs) are investment funds that are traded on stock exchanges like individual stocks. ETFs are designed to track the performance of a specific index or group of assets, such as stocks, bonds, or commodities. ETFs can provide investors with exposure to a diversified portfolio of assets at a lower cost than buying individual securities. They can also be easily bought and sold throughout the trading day.
Exchange-traded funds (ETFs) and mutual funds can provide investors with a diversified portfolio of assets, which can reduce risk and volatility compared to investing in individual stocks or bonds. However, the returns, risks, and volatility of ETFs and mutual funds depend on the underlying assets they invest in.

Mutual Funds

Mutual funds are investment vehicles that pool money from multiple investors to invest in a diversified portfolio of assets, such as stocks, bonds, or a combination of both. Mutual funds are managed by professional portfolio managers who make investment decisions on behalf of the fund's investors. The value of a mutual fund is determined by the performance of its underlying assets. Mutual funds can provide investors with diversification, professional management, and the ability to invest in a wide range of assets with a relatively small amount of money.
In terms of returns, mutual funds typically aim to provide investors with competitive returns that are in line with the market or a specific asset class, such as stocks or bonds. The returns of a mutual fund are determined by the performance of the underlying assets it invests in, as well as the fees and expenses charged by the fund.

The risk of a mutual fund depends on the specific assets it invests in and the investment strategy employed by the fund manager. For example, a mutual fund that invests primarily in stocks may be considered riskier than a fund that invests mainly in bonds. Additionally, mutual funds that invest in smaller or less established companies may be riskier than those that invest in larger, more established companies. The risk of a mutual fund can be measured by metrics such as standard deviation or beta.

Steps

1) ### Data Collection Using Forms

   Predicting what field should the person invest in depends on their wishes. So, the first step is to collect relevant data to know the investing pattern the user follows or wants to follow. So, an HTML form was created which took the inputs from the user like their age, income, investing experience(no experience, some experience, or experienced), risk

they want to take(Low risk, medium risk, or high risk), their investing style(Conservative, Balanced, Aggressive), Investment Horizon (Long term, medium term, or short term), types of products they want to invest in(stocks, bonds, EFTs, or mutual funds). CSS was also added. The HTML file was saved as index.html in the Templates folder whereas, in the static folder, the CSS code was saved as styles.css.

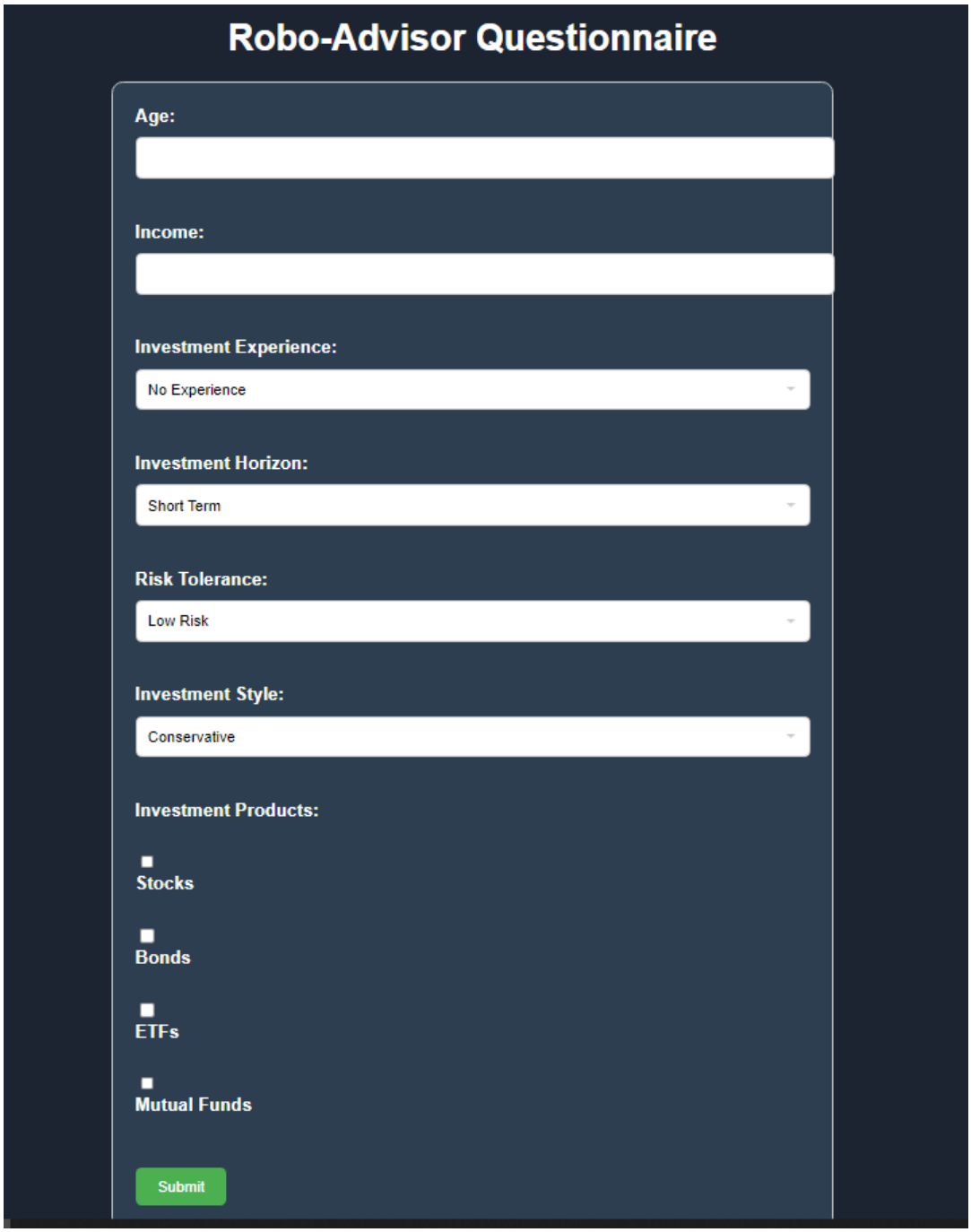


Fig: HTML form page to collect user data

2) Data Storage in Database Table

The user data will be required in the backend to process. So using SQLite, the user table was created which stored all the necessary data to use it in the future. As there are no identifying keys in the form, no column is made primary. But, the column that was stored the latest was taken as the current user is the one who just had filled the form. Then, the details of the user were taken and used for further processing.

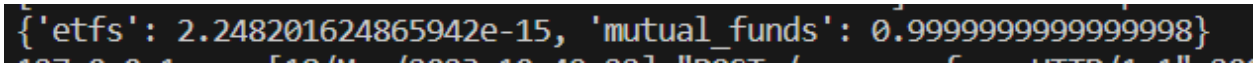
age	income	experience	horizon	risk	style	products
20	20000	no_experience	short_term	low_risk	conservative	stocks
30	30000	some_experience	medium_term	medium_risk	aggressive	stocks
20	40000	no_experience	short_term	low_risk	conservative	stocks
40	40000	no_experience	short_term	low_risk	conservative	
50	50000	no_experience	short_term	low_risk	conservative	stocks,bonds,etfs,mutual_funds
20	60000	some_experience	medium_term	high_risk	aggressive	stocks,bonds,etfs,mutual_funds
40	40000	experienced	medium_term	high_risk	balanced	stocks,etfs,mutual_funds
40	40000	experienced	medium_term	medium_risk	aggressive	stocks,etfs,mutual_funds
40	100000	experienced	medium_term	high_risk	balanced	stocks,etfs,mutual_funds
40	100000	experienced	medium_term	high_risk	balanced	stocks,etfs,mutual_funds
40	100000	experienced	medium_term	high_risk	balanced	stocks,etfs,mutual_funds
40	100000	experienced	medium_term	high_risk	balanced	stocks,etfs,mutual_funds

Fig: Snippet of user data present in the user table

3) Calculating Risk and Finding the Best Area to Invest

With the given inputs, the coefficients of each input are taken into consideration. Eg, consider experience. A person with experience in the stock market is likely to have an instinct on what to invest and when to invest. So, seeing an opportunity, they might also want to invest in riskier short-term stocks to get instant benefits. But, someone who is young, has less income, and is new to the investment arena might consider long-term steady returns generally provided by bonds.

The risk score for each candidate is taken out. Scipy's minimize function is used to optimize the risk score and provide recommendations to the user. The recommendation is in the form of a recommended product, and recommended allocation.



This person is suggested to invest in mutual funds looking at their input data.

4) Display the Output to the User

The user might not understand the output in terms of a dictionary or a list. So, a range of interactive outputs is prepared for the user's better understanding.

Eg: Consider the following input values:

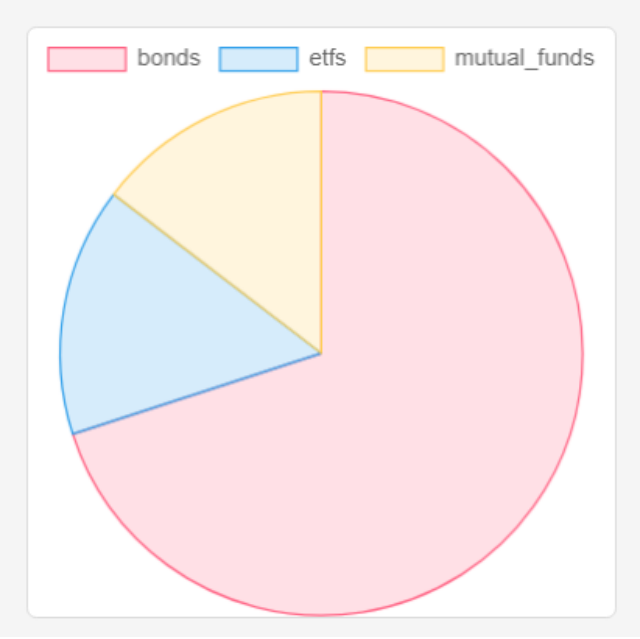
Age: 60
Income: 300000
Investment Experience: Some Experience
Investment Horizon: Medium Term
Risk Tolerance: Medium Risk
Investment Style: Aggressive
Investment Products: Stocks, Bonds, EFTs, Mutual Funds

Here are the outputs.

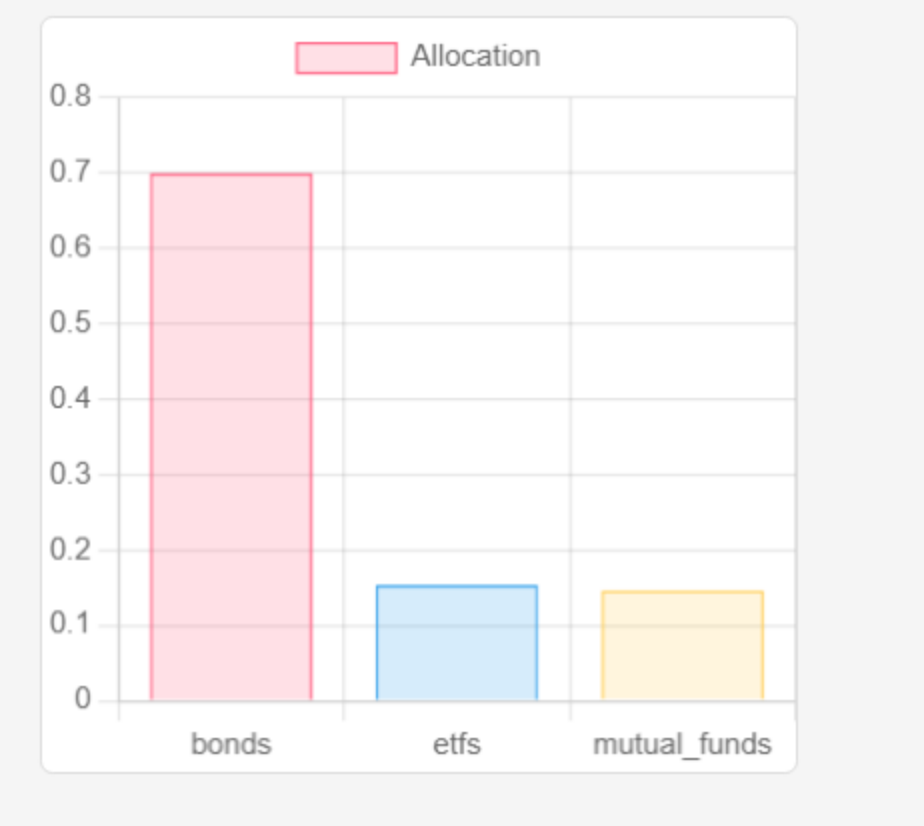
Recommended Products

Product	Allocation
bonds	0.700059121327404%
etfs	0.1536259171039879%
mutual_funds	0.14631496156860824%

This is a table showing products and their respective allocation.



The same result can also be shown by a pie chart.



Or, a bar chart.

This is the result.html page present in the templates. Another page called analytics.html is accessible through this results.html.

View portfolio performance and set notification preferences.

5) Provide Analytics of the Selected Company and take the Threshold Value to send an Email

   The analytics of given companies take a huge amount of time and difficulty to create as there can be 100s of analyses done to 1000s of companies. But, I have only included a line graph showing the price increase of a company over time.

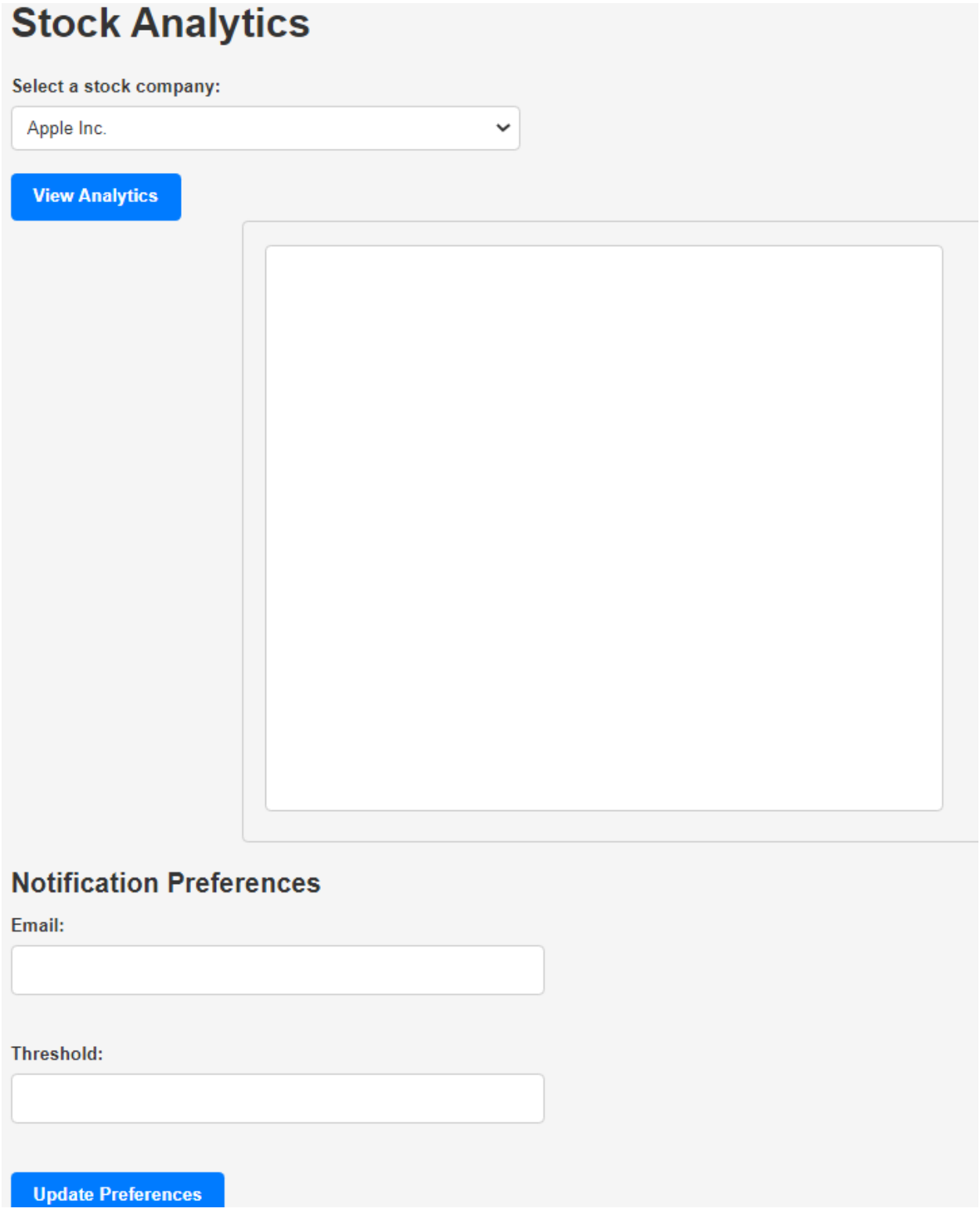
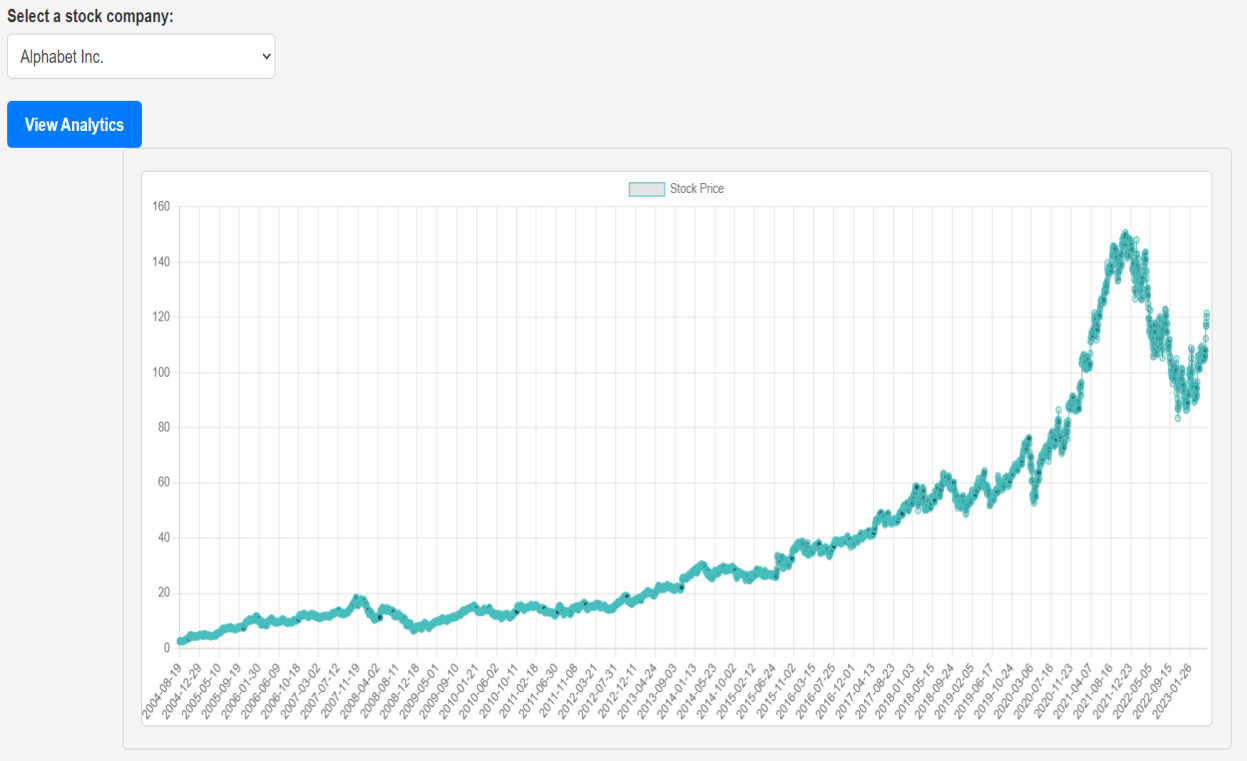
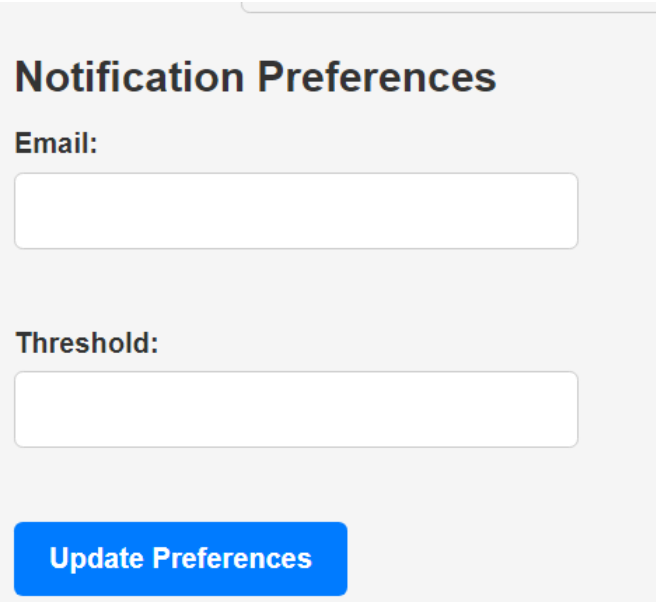


Fig: Landing Page for Analysis and Notification Preferences

Selecting a company:



SMTP method is used to send e-mail to the user.



Mention a price as a threshold. If the current price exceeds the threshold, an e-mail is sent to the user notifying them about the price.

Result and Conclusion

A basic robo advisor for investment portfolio management is created. The project is far away from the objectives set. But given the time constraints, this is the best I could do.
The result is an interactive form showing users where to invest in terms of sub-domains.

The project is only a high-level overview. Given time and resources, the project can be improved on a larger scale. After the investment products are suggested, the user may be given names of companies of the products doing well and be bought by the user. Also, detailed investments of many companies might be shown. Users might be asked about their current investments and after analyzing those, a dynamic rebalancing of the portfolio might be suggested in real-time.