Rupi Corp

Final Report

(https://github.com/ChubsB/AI-Based-Stock-Investments)

(Provide KayDrive link to the project here)

BY

Team Lead: Syed Hussain Imam/19773

Member(s): ***Ahmed Abdul Ghafoor 19735***

***Huzaifa Farooq 19766***

***Mohammad Razi Moosa 18663***

UNDER THE SUPERVISION OF

SUPERVISOR: Dr. Tahir Syed

CO-SUPERVISOR: -

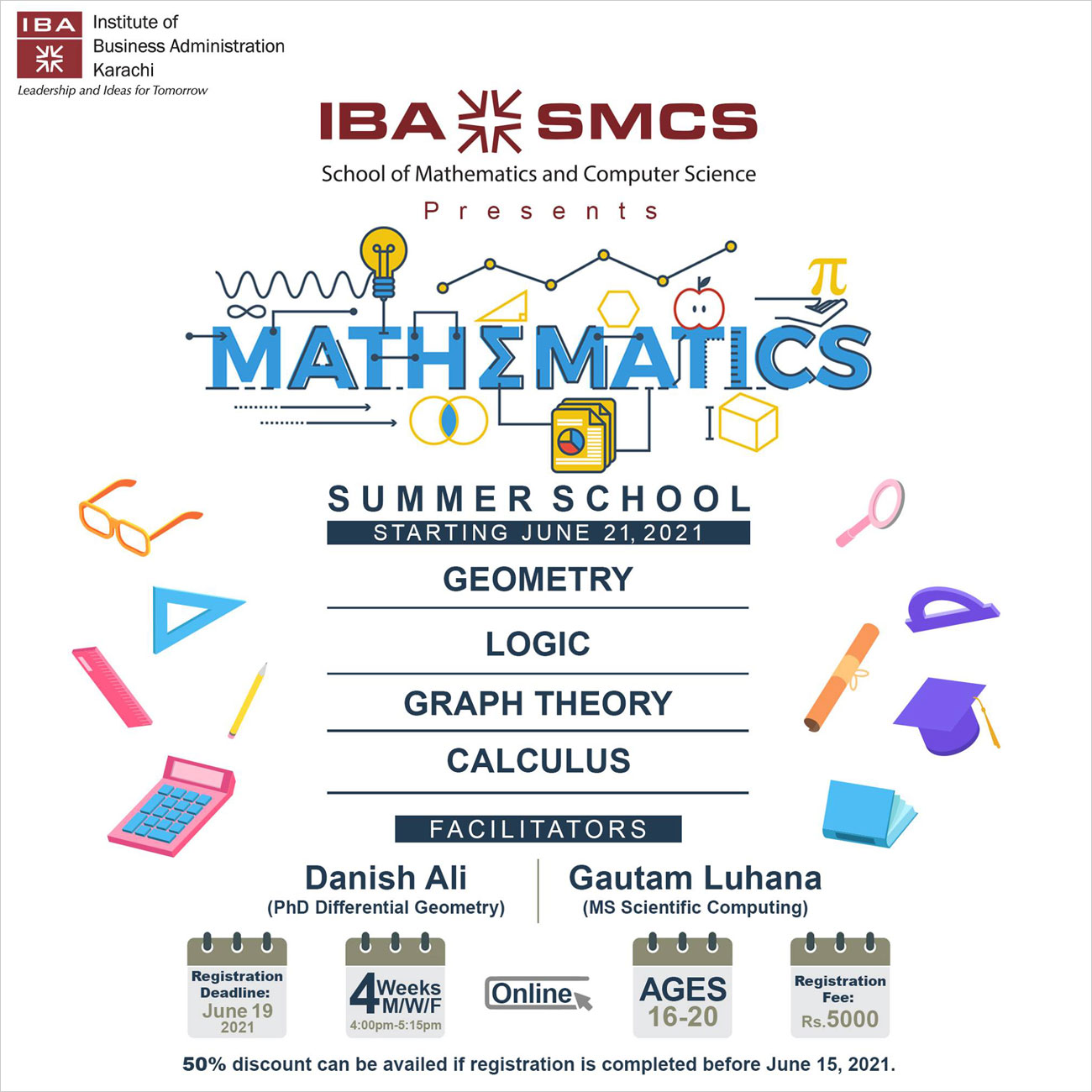
Member(s): NAME(S)

**SUBMITTED TO**

pROJECTS Manager – FYP

**ON**

DATE (01/05/2023)



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CONTRIBUTIONS

Each FYP team member should present their contributions to the project here in a separate matrix followed by their name in BOLD.

Details regarding:

* requirements specification (use cases and non-functional requirements),
* domain modeling (whole system or list the specific modules),
* software design (whole system or list the specific modules),
* report preparation (whole report or list the specific sections/diagrams),
* Other: any other relevant contribution.

Use extra pages if required. If more than one person has worked on a component jointly then specify the percentage each has contributed to that component.

Table of Contents

Proposal Defence Report

**Introduction**

This report presents the defense of a proposed stock market prediction platform utilizing machine learning techniques. The platform aims to provide individual and institutional investors with accurate stock price predictions and advisory services to make informed investment decisions.

**Problem Statement**

Making sound investment decisions is an extremely difficult task for investors due to the vast amount of information required to consistently beat the market. The proposed stock market advisory platform aims to address this challenge by leveraging artificial intelligence techniques, focusing on technical analysis and the impact of psychological factors on stock prices and trends.

**Objectives**

The primary objectives of the proposed platform include:

Developing a user-friendly web application that provides accurate stock price predictions for stocks in the KSE-100 index.

Offering portfolio management and analysis tools for investors to make informed decisions.

Encouraging individual investor engagement in the Pakistan Stock Exchange (PSX) by providing crucial information and advice.

**Methodology**

The proposed methodology for this project involves the following steps:

Researching existing machine learning techniques and algorithms for stock market prediction.

Identifying and collecting relevant financial data, such as historical stock prices and macroeconomic indicators.

Designing and implementing the machine learning model to predict stock prices.

Developing the web application with a user-friendly interface for investors to access predictions, manage portfolios, and receive advisory services.

Conducting testing and validation of the platform to ensure its effectiveness and accuracy.

Continuously refining the platform based on user feedback and market developments.

**Expected Outcomes**

Upon successful completion of this project, the expected outcomes include:

A fully functional stock market advisory platform that provides accurate stock price predictions.

Increased individual investor engagement in the Pakistan Stock Exchange (PSX).

Improved decision-making capabilities for both individual and institutional investors.

Software Requirement Specification (SRS)

# Problem Statement

The challenge of making well-informed investment decisions in the stock market has grown increasingly difficult due to the vast amount of information required to consistently outperform the market. Individual investors, in particular, heavily rely on publicly available news sources and sentiment analysis. Although the Efficient Market Hypothesis contends that all available information is already reflected in current stock prices, there is significant evidence suggesting that markets are not entirely efficient.

To capitalize on this inefficiency, our project aims to develop a stock advisory platform utilizing artificial intelligence techniques and a technical analysis approach, focusing on the psychological factors that influence future stock prices and trends. By evaluating and refining existing techniques, such as Moving Averages (MA), Auto Regressive Integrated Moving Average (ARIMA), and other AI-based methods, we strive to enhance the accuracy of stock price predictions and provide valuable insights for users.

Initially launched as a publicly available web application, the advisory platform will transition to a subscription-based model for individual and institutional investors. Offering comprehensive stock information for all stocks in the KSE-100 regular index, the platform will visualize prediction outcomes and furnish investment advice tailored to users' preferences. Furthermore, users can filter, select, and follow stocks of their choice.

Given the low level of individual investor engagement in the Pakistan Stock Exchange (PSX) compared to other countries, this platform also seeks to encourage greater participation in the PSX by delivering crucial information and guidance that is currently difficult for novice users to comprehend or locate in existing data portals. Our goal is to create an accessible and user-friendly tool that empowers individuals to make informed decisions in the stock market.

# System Requirement

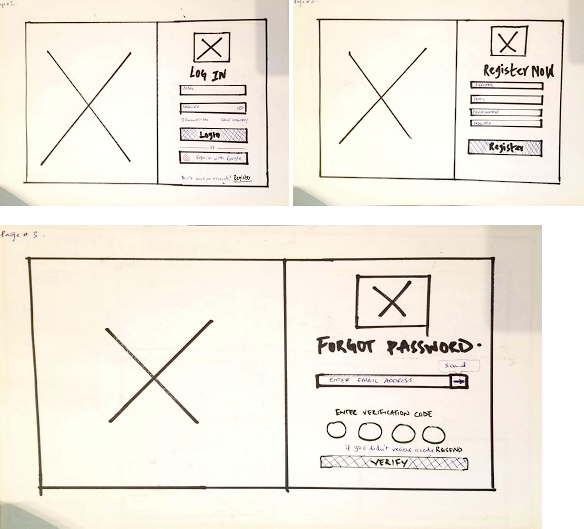
## List of Functional Requirements

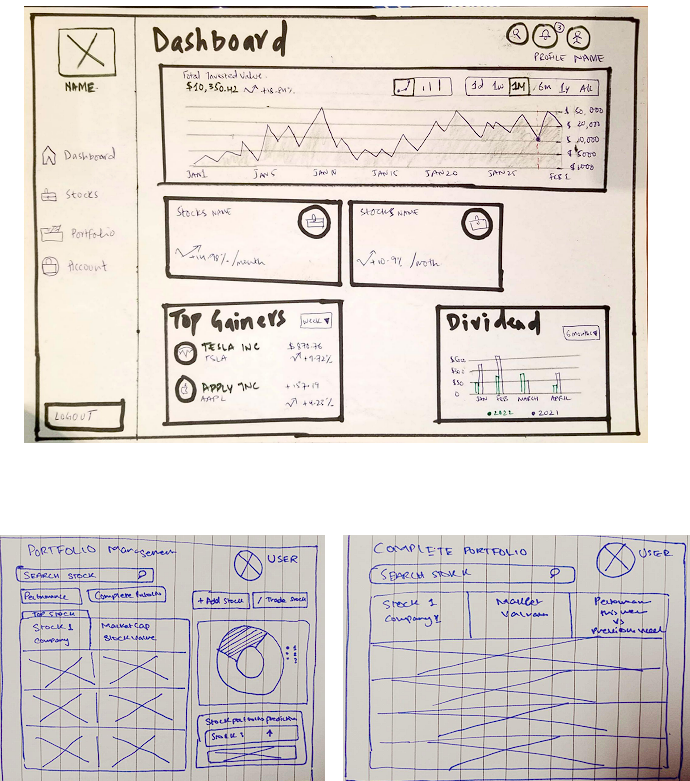
|  |  |
| --- | --- |
| **Functional Requirement No.** | **Functional Requirement Description** |
| FR01 | User Authentication - The system will be able to authenticate users through user accounts (Username/Email + Password), ensuring secure access to personalized data and features. |
| FR02 | User Registration - The system will provide a seamless registration process for new users, enabling them to create their account and access the platform. |
| FR03 | Stock Price Data Display - The system will display comprehensive stock price data for all stocks in the KSE-100 index, providing users with the information necessary for informed decision-making. |
| FR04 | Portfolio Creation - The system will allow users to create a custom portfolio, enabling them to manage and track their preferred stocks more efficiently. |
| FR05 | Portfolio Management - The system will enable users to add or remove stocks from their portfolio, ensuring that their investment preferences are always up to date. |
| FR06 | Stock Price Prediction - The system will offer stock price predictions for all stocks in the KSE-100 index, leveraging AI-based techniques and technical analysis to provide users with valuable insights. |
| FR07 | Portfolio Value Tracking - The system will display both the current and predicted future values of users' portfolios, enabling them to make informed decisions regarding their investments. |
| FR08 | Daily Stock Price Data Retrieval - The system will retrieve daily stock price data from reliable data sources, ensuring that users have access to the most recent and accurate information. |

## List of Non-functional Requirements

|  |  |
| --- | --- |
| Non-Functional Requirement No. | Non-Functional Requirement Description |
| NFR01 | Usability - The system will offer an intuitive and user-friendly interface, allowing users with varying levels of investment experience to easily navigate and utilize the platform. |
| NFR02 | Performance - The system will deliver prompt responses and maintain optimal performance levels, ensuring that users can access stock information, predictions, and portfolio data with minimal latency. |
| NFR03 | Scalability - The system will be designed to accommodate an increasing number of users and data processing requirements, enabling it to scale as the platform's user base and features expand. |
| NFR04 | Security - The system will implement robust security measures, including encryption and secure communication protocols, to protect users' personal and financial data from unauthorized access. |
| NFR05 | Reliability - The system will be designed with redundancy and error-handling capabilities to minimize downtime and ensure consistent availability of the platform. |
| NFR06 | Data Accuracy - The system will incorporate rigorous data validation and quality control processes to ensure that stock price information, predictions, and other data are accurate and up to date. |
| NFR07 | Maintainability - The system will be designed with modularity and adherence to best practices, enabling easy updates, bug fixes, and feature enhancements without causing significant disruptions to the platform's operation. |
| NFR08 | Compatibility - The system will be compatible with a wide range of devices and browsers, ensuring that users can access the platform from their preferred device and browser. |
| NFR09 | Responsiveness - The system will be designed with a responsive user interface, adapting to different screen sizes and resolutions, providing an optimal user experience across various devices. |

## User Interface Requirements





# Functional Requirements Specification

## Stakeholders

* Individual Investors - Users who will access the platform to manage their investments and seek reliable stock price predictions.
* Institutional Investors - Organizations that will use the platform for research and investment management purposes.
* Platform Developers - The team responsible for designing, implementing, and maintaining the stock advisory platform.
* Data Providers - Third-party sources that provide stock market data and relevant financial information.

## Actors and Goals

Actors:

* Registered Users - Users who have completed the registration process and can access the platform's features.
* Administrator - The individual(s) responsible for managing the platform, including user accounts, data updates, and system maintenance.

Goals:

* Provide users with accurate stock price predictions and investment advice.
* Enable users to create, manage, and track custom portfolios.
* Offer comprehensive stock information for all stocks in the KSE-100 index.
* Increase individual investor engagement in the Pakistan Stock Exchange (PSX).

## Use Cases

**Use Case 1: User Authentication**

Actor: Registered User

Description: The user logs into the platform using their credentials (Username/Email + Password).

Preconditions: The user has a valid account.

Postconditions: The user is granted access to personalized features, such as portfolio management and stock price predictions.

**Use Case 2: User Registration**

Actor: Guest User

Description: The user registers for a new account, providing necessary information such as username, email, and password.

Preconditions: The user does not have an existing account.

Postconditions: The user creates a new account and gains access to the platform's features.

**Use Case 3: Portfolio Creation**

Actor: Registered User

Description: The user creates a custom portfolio to manage and track their preferred stocks.

Preconditions: The user is logged in.

Postconditions: The user has a new portfolio to monitor their investments.

**Use Case 4: Portfolio Management**

Actor: Registered User

Description: The user adds or removes stocks from their portfolio.

Preconditions: The user has an existing portfolio.

Postconditions: The user's portfolio is updated to reflect their investment preferences.

**Use Case 5: Accessing Stock Price Predictions**

Actor: Registered User, Guest User

Description: The user views stock price predictions for all stocks in the KSE-100 index.

Preconditions: None.

Postconditions: The user obtains valuable insights for potential investments.

# User Interface Specification

**Use Case 1: User Authentication**

Login Page: This page will include input fields for the user to enter their username/email and password, along with a "Log In" button. Additionally, a "Forgot Password" link and a "Register" button for new users will be provided.

**Use Case 2: User Registration**

Registration Page: This page will contain input fields for the user to provide their username, email, and password, as well as a "Create Account" button. A link to the login page for existing users will also be available.

**Use Case 3: Portfolio Creation**

Portfolio Page: A "Create Portfolio" button will be displayed, which opens a modal containing an input field for the portfolio name and a "Save" button to create the new portfolio.

**Use Case 4: Portfolio Management**

Portfolio Page: The user's portfolio will be displayed with a list of stocks, including stock names, symbols, and current prices. An "Add Stock" button will open a modal with a search bar to find and select stocks to add to the portfolio. Each stock in the list will have a "Remove" button to remove the stock from the portfolio.

**Use Case 5: Accessing Stock Price Predictions**

Stock Prediction Page: This page will display a list or a table containing all stocks in the KSE-100 index, with columns for stock names, symbols, current prices, and predicted prices. Users can filter or search for specific stocks. Clicking on a stock will open a detailed view with historical price data, prediction charts, and other relevant information.

# Domain Analysis

**Domain Model:**

**User:**

Attributes: UserID, Username, Email, Password, Portfolio

Relationships: Owns a Portfolio, Interacts with Stock, Views StockPricePrediction

**Portfolio:**

Attributes: PortfolioID, Name, User, Stocks

Relationships: Belongs to User, Contains multiple Stocks

**Stock:**

Attributes: StockID, StockName, Symbol, StockPrice, StockPricePrediction

Relationships: Belongs to Portfolio, Associated with StockPricePrediction

**StockPricePrediction:**

Attributes: PredictionID, Date, PredictedPrice

Relationships: Linked to Stock

**Mathematical Models:**

Moving Averages (MA): A simple method to smoothen stock price data, making it easier to identify trends.

Simple Moving Average (SMA): SMA = (P1 + P2 + ... + Pn) / n

Exponential Moving Average (EMA): EMA = (Close - Previous EMA) \* (2 / (n + 1)) + Previous EMA

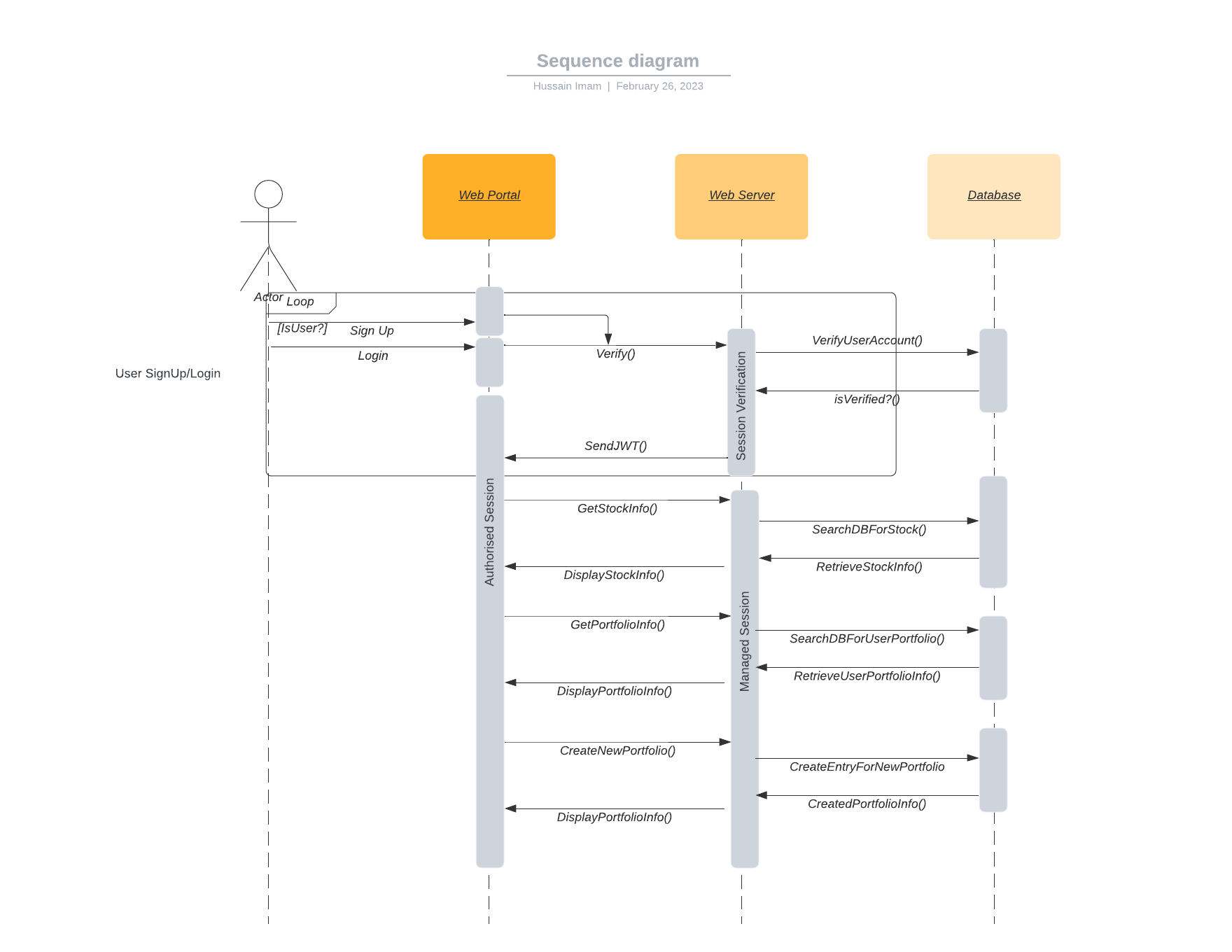
Auto Regressive Integrated Moving Average (ARIMA): A time series forecasting model that combines autoregression, differencing, and moving averages.

ARIMA(p, d, q): p = order of autoregression, d = degree of differencing, q = order of moving average.

AI-based Techniques: Various machine learning and deep learning algorithms can be used to predict stock prices, such as Long Short-Term Memory (LSTM) networks, Support Vector Machines (SVM), or Random Forests.

System Design

# Interaction Diagrams

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# Class Diagram and Interface Specification

Show all classes and their associations. If cannot fit on a single-page, make an overview diagram showing all classes and their associations with just name. Details with attributes can be depicted in partial diagrams.

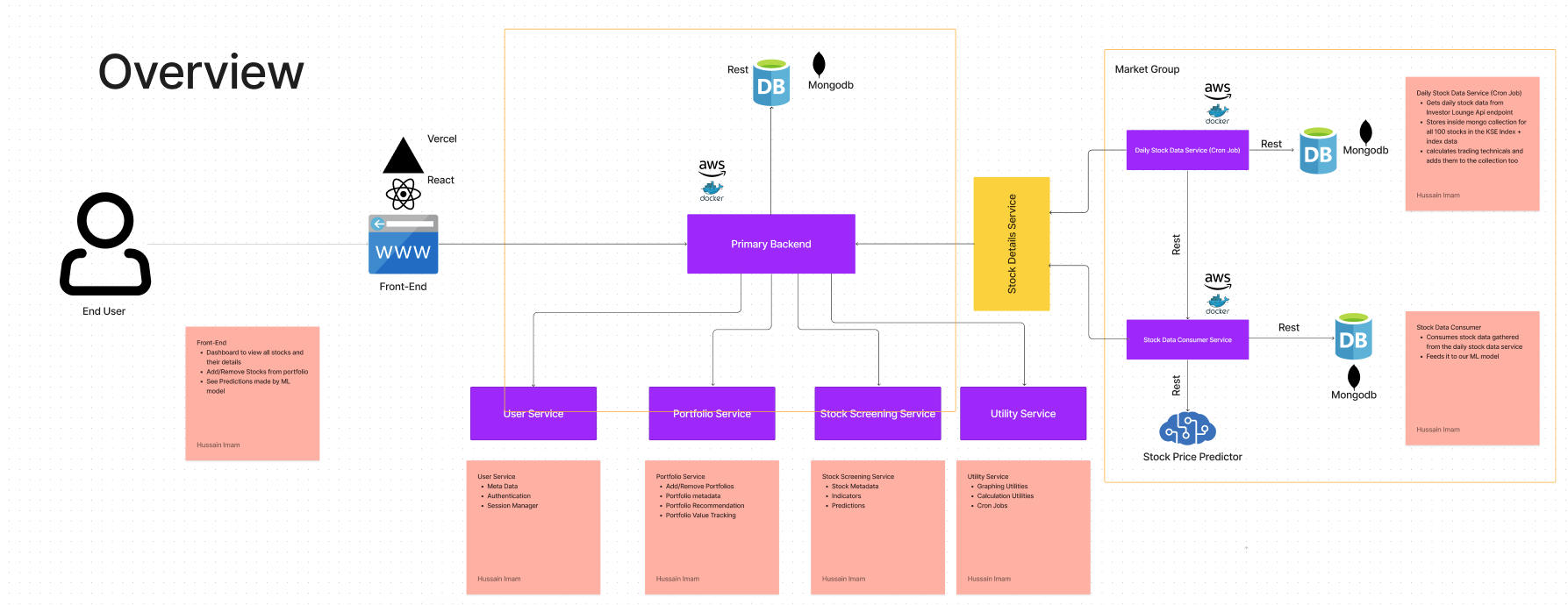
Use UML notation for class specification with datatypes for each class.

# System Architecture and System Design

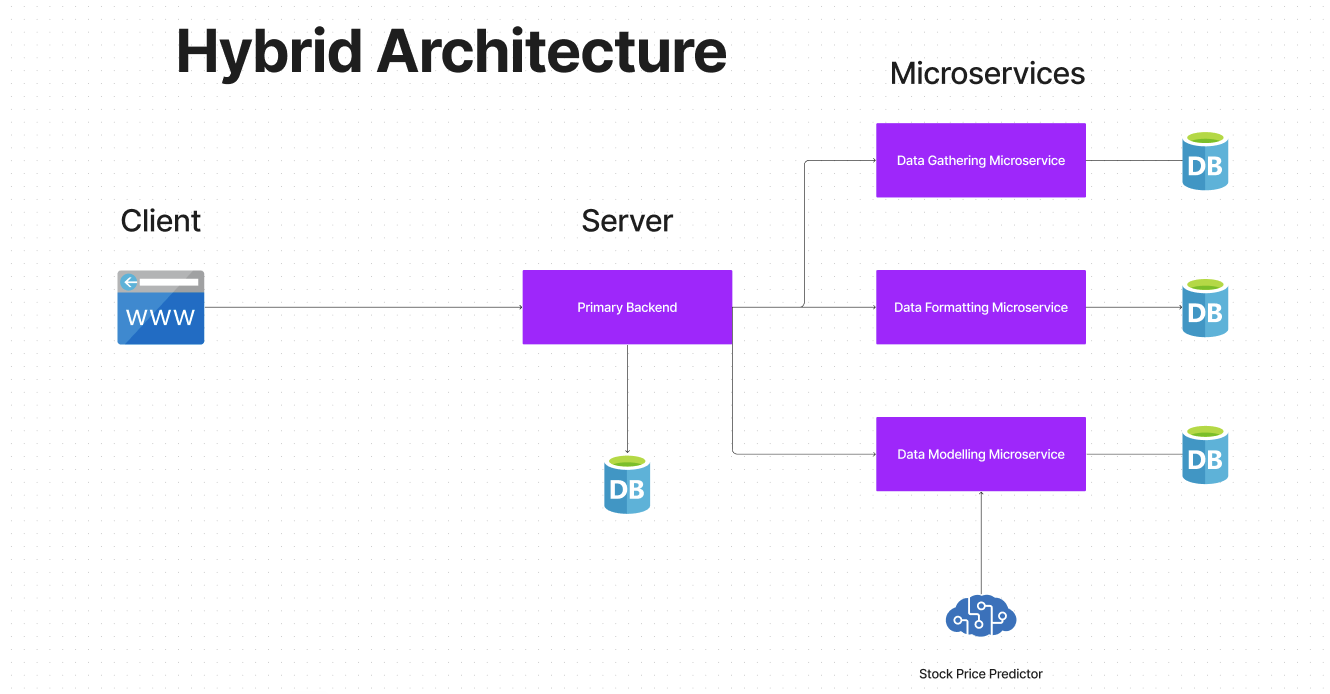
## Architectural Style

Client – Server Architecture: Our system is segregated into two major components our client (Browser Portal) and our server (Nodejs Backed) + Database (MongoDB/MySQL). Although for the most part our architecture is heavily centered around Client – Server fundamentals. Some of our services fall outside our monolithic backend and follow the microservice pattern i.e. Data collection, Data Formatting and Data modelling services

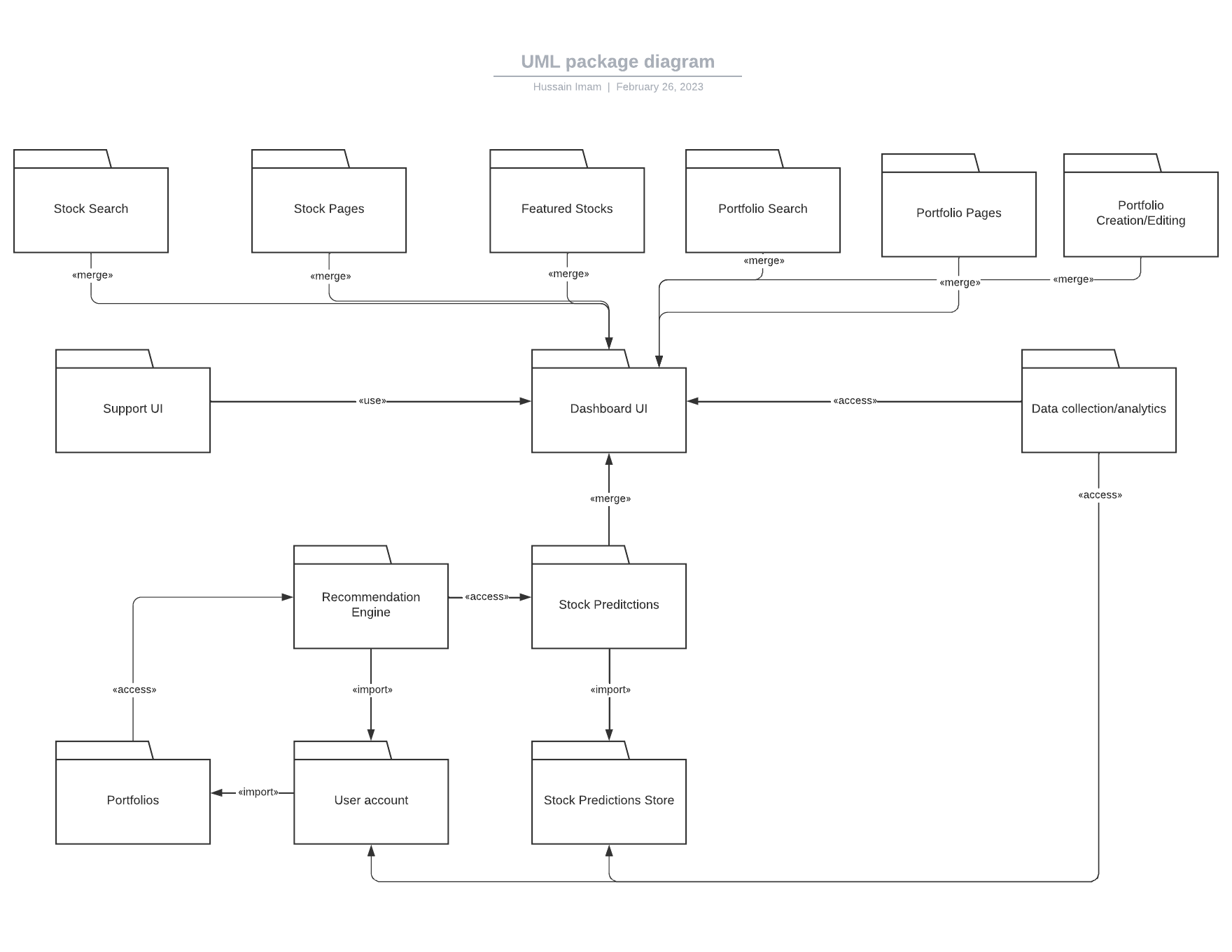
**Complete Architecture:**

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**Client – Server + Microservices:**



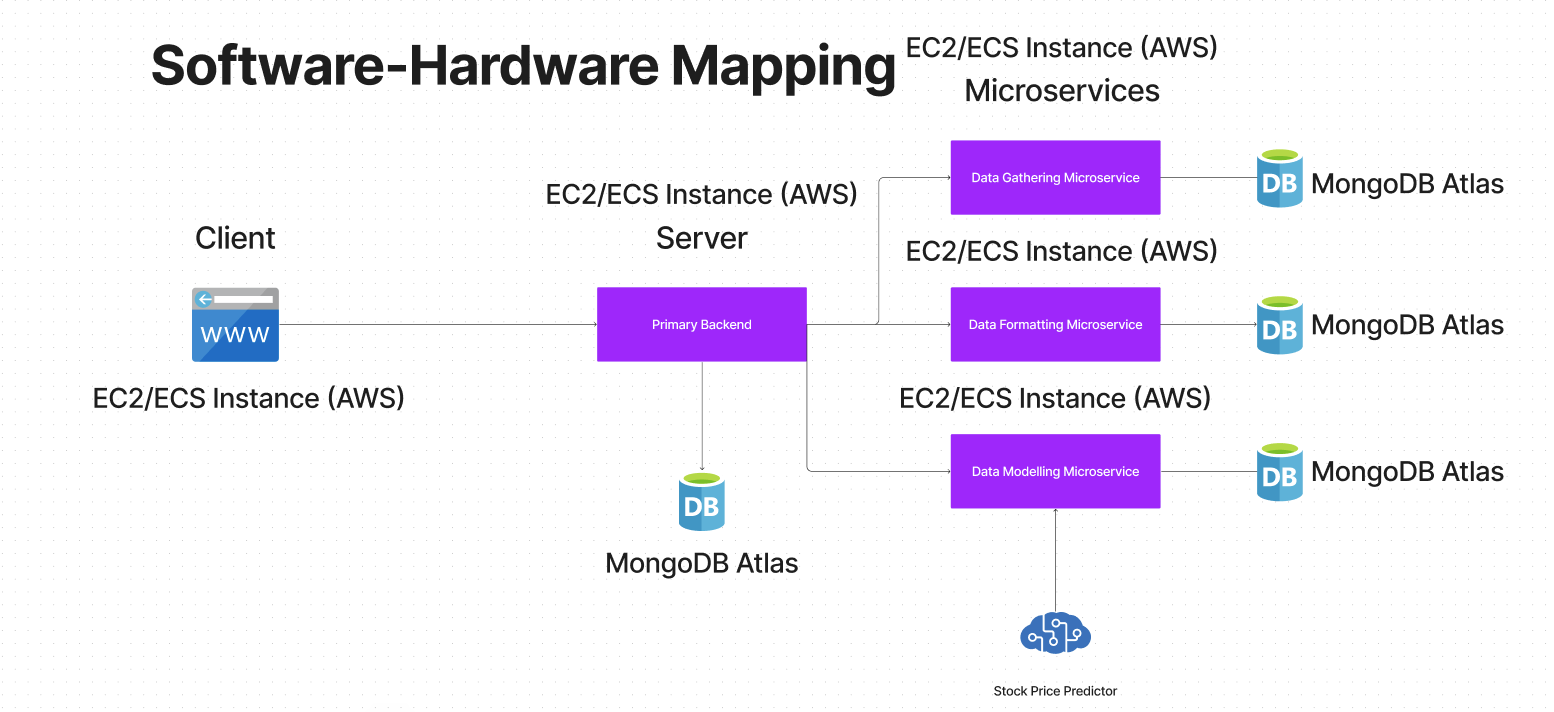
## Identifying Subsystems



## Mapping Subsystems to Hardware

Components in our architecture:

* Client (Reactjs Frontend): EC2 instance (AWS)
* Primary Backend (Nodejs): EC2 instance (AWS)
* Microservices: EC2 instance (AWS)
* Database: EC2 instance (AWS) / MongoDB Atlas



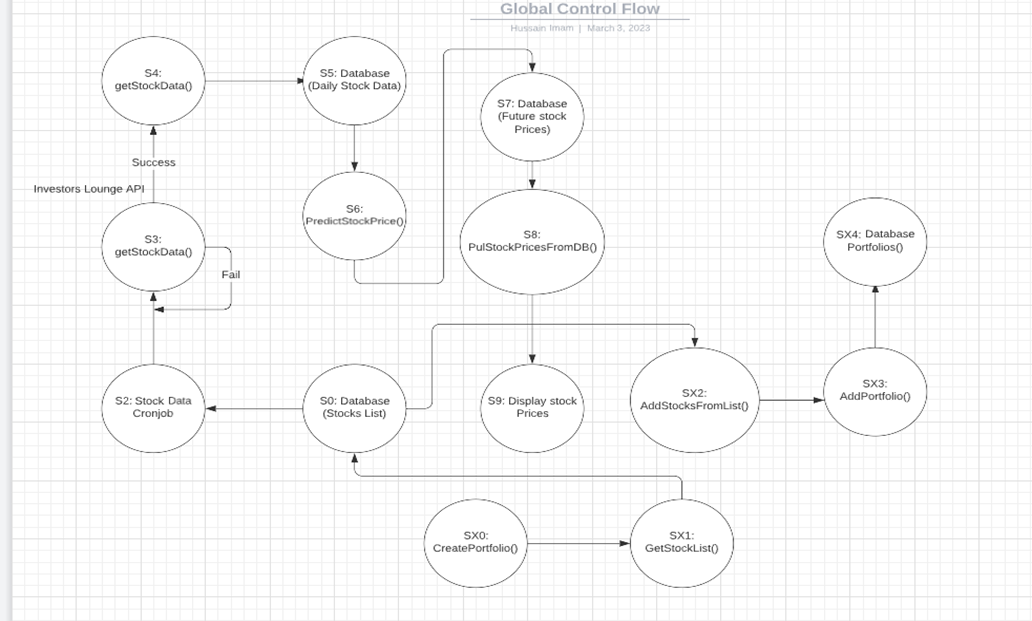
## Persistent Data Storage

Attach the description of the file format and/or database schema (format of database tables, printed by the command description)

## Network Protocol

Our application will be following the principles of RESTful web architectures; hence all communication will use HTTP/HTTPS.

## Global Control Flow



## Hardware/Sofware Requirements

**Recommended Operating Systems:**

Windows: 7 or newer

MAC: OS X v10.7 or higher

Linux: Ubuntu

**Hardware Requirements:**

We strongly recommend a computer fewer than 5 years old.

* Processor: Minimum 1 GHz; Recommended 2GHz or more
* Ethernet connection (LAN) OR a wireless adapter (Wi-Fi)
* Hard Drive: Minimum 32 GB;Recommended 64 GB or more
* Memory (RAM): Minimum 1 GB; Recommended 4 GB or above

**Supported Browsers:**

People often ask what browser they should use. There is no single answer for this. Use whichever browser works best on your computer. However, we recommend downloading Firefox and/or Chrome in addition to having Internet Explorer or Safari.

* FireFox
* Chrome
* Edge
* Safari
* Opera
* Brave

# Algorithms and Data Structures

**Algorithms:**

Moving Averages (MA): The platform will calculate Simple Moving Averages (SMA) and Exponential Moving Averages (EMA) to identify trends in stock prices. These calculations will be performed using time-series data for each stock.

Auto Regressive Integrated Moving Average (ARIMA): The platform will use the ARIMA algorithm to forecast stock prices based on historical data, autoregression, differencing, and moving averages. The algorithm will be tuned with appropriate parameters (p, d, q) for each stock.

Machine Learning and Deep Learning Algorithms: The platform may incorporate various ML and DL techniques to enhance prediction accuracy. Some potential algorithms include:

Long Short-Term Memory (LSTM) networks: A type of recurrent neural network capable of learning long-term dependencies in time-series data.

**Data Structures:**

Arrays

Hash tables

# User Interface Design and Implementation

During the development process, it is common for the initial user interface design to undergo modifications based on evolving requirements. These changes aim to improve the platform's ease of use and overall user experience. Below are some examples of potential modifications made to the initial user design:

**Simplified Navigation**: After reviewing the initial design, the navigation structure may be simplified and reorganized to ensure users can easily access the platform's main features, such as stock predictions, portfolio management

**Enhanced Visualizations**: The initial design's data visualizations, such as stock price prediction charts, could be improved with better color schemes, tooltips, and interactivity to make the information more accessible and engaging for users.

**Responsive Design**: If the initial design did not account for various devices and screen sizes, the implementation phase would include adjustments to ensure the platform adapts to different resolutions and provides an optimal user experience across devices.

**Improved Input Validation**: Based on user feedback, the platform's input validation and error handling may be enhanced to guide users more effectively and prevent input-related issues.

**Consolidation of Features:** Some features or interface elements may be combined or restructured to reduce clutter and simplify the user experience. For example, stock search and filtering functionality may be combined into a single, easy-to-use component.

By iterating on the initial design and making adjustments as needed, the stock advisory platform can provide an intuitive and user-friendly experience that meets the needs of a diverse range of users.

# Design of Tests

Tests will be conducting using the Nodejs testing library called Jest (Testing Framework)

|  |  |  |  |
| --- | --- | --- | --- |
| Id | Test Case | Input Value | Expected Output |
| 1 | Sign Up | Email: [xyz@gmail.com](mailto:xyz@gmail.com)  Password: 1234Admin | Auth Token: JWT \*\*\*\* |
| 2 | Login | Email: [xyz@gmail.com](mailto:xyz@gmail.com)  Password: 1234Admin | Auth Token: JWT \*\*\*\* |
| 3 | Get stock data | Ticker: ABL | ABL Stock Data Object |
| 4  5 | Get Portfolio  Create Portfolio | Portfolio\_id: 3A21  PortfolioName: XYZ  Stocks: {  ABL: 25%  ENGRO: 25%  PIBTL: 50%  } | User Portfolio Object  Success: 200 (Reponse) |
| 6 | Edit Portfolio | Portfolio\_id: 3A21  Stocks: {  ABL: 55%  PIBTL: 45%  } | Success: 203 (Reponse) |

\*Frontend testing will consist of manual end-end testing according to specified user journeys.

User Manual

Stock Advisory Platform User Manual

**Introduction**

The Stock Advisory Platform is designed to provide users with accurate stock price predictions, investment advice, and portfolio management tools. This user manual will guide you through the platform's features, helping you make informed investment decisions and effectively manage your portfolio.

**Getting Started**

**2.1. Registration**

To access the platform's full features, you need to create an account. Follow these steps:

Click on the "Register" button on the homepage.

Fill in the required fields, including username, email, and password.

Click on the "Create Account" button.

**2.2. Logging In**

If you already have an account, follow these steps to log in:

Click on the "Log In" button on the homepage.

Enter your username/email and password.

Click on the "Log In" button to access your account.

Navigating the Platform

**3.1. Stock Predictions**

To view stock price predictions for all stocks in the KSE-100 index:

Click on the "Stock Predictions" tab in the main navigation menu.

Browse the list or use the search/filter functionality to find specific stocks.

Click on a stock to view detailed information, including historical price data, prediction charts, and other relevant data.

**3.2. Creating a Portfolio**

To create a custom portfolio for managing and tracking your preferred stocks:

Click on the "Portfolios" tab in the main navigation menu.

Click on the "Create Portfolio" button.

Enter a name for your new portfolio and click "Save."

**3.3. Managing Your Portfolio**

To add or remove stocks from your portfolio:

Click on the "Portfolios" tab in the main navigation menu.

Select the portfolio you want to manage.

Click on the "Add Stock" button to search and add stocks to your portfolio.

To remove a stock, click the "Remove" button next to the stock in your portfolio list.

Project Management and Plan

**Proposed Timelines:**

**Phase 1: Research and Planning (2 weeks)**

Market analysis

Competitor analysis

Identifying user requirements

**Phase 2: Design and Development (8 weeks)**

User interface design

Algorithm selection and development

Data structure implementation

Backend development

Frontend development

**Phase 3: Testing (2 weeks)**

Unit testing

Integration testing

Usability testing

**Phase 4: Deployment (1 week)**

Deploying the application to production

Finalizing user documentation

**Phase 5: Post-launch Support and Maintenance (ongoing)**

Monitoring user feedback

Resolving issues

Implementing improvements and updates

Current Status and Future Work

**Current Status:**

As of now, the Stock Advisory Platform has been successfully deployed and is operational. The platform offers users the ability to access accurate stock price predictions, manage custom portfolios, and view performance reports for both individual stocks and their portfolios. The core functionalities, including registration, login, stock predictions, portfolio management, and reporting, are all working as intended.

The platform has also undergone rigorous testing and refinements to ensure a user-friendly experience. User feedback and analytics have been collected and analyzed, leading to several improvements in the user interface, navigation, and overall user experience. The platform is accessible across various devices and screen sizes, thanks to the implementation of responsive design.

**Future Work:**

Moving forward, the Stock Advisory Platform team plans to focus on the following areas to further enhance the platform's capabilities and user experience:

Algorithm Improvement: Continually refine and enhance the predictive algorithms used for stock price forecasting, incorporating new techniques from machine learning and deep learning research to improve prediction accuracy.

Expansion of Stock Coverage: Expand the platform's coverage to include more stocks beyond the KSE-100 index, allowing users to access predictions and manage portfolios for a broader range of investments.

Integration with External Data Sources: Incorporate additional data sources, such as social media sentiment analysis, to provide more context and insights into the factors influencing stock prices.

Advanced Portfolio Analysis Tools: Develop more sophisticated portfolio analysis tools that enable users to perform risk assessments, optimize asset allocation, and simulate various investment scenarios.

Mobile App Development: Create a mobile app version of the platform to offer users more convenience and accessibility, allowing them to manage their investments and view predictions on the go.

User Education and Community Building: Develop educational resources and foster a community for users to learn more about investing, share their experiences, and engage with one another to make better-informed investment decisions.

By focusing on these future developments, the Stock Advisory Platform aims to become an essential tool for individual and institutional investors alike, offering valuable insights and guidance for making sound investment decisions.

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