DON BOSCO COLLEGE OF ENGINEERING

FATORDA, MARGAO, GOA – 403 602.

DEPARTMENT OF COMPUTER ENGINEERING

2022 – 2023

"FinanceMetrics"

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DON BOSCO COLLEGE OF ENGINEERING

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CERTIFICATE

This

Second Year Project Report 'FinanceMetrics'

Submitted the Termwork in the subject Object Oriented Software Engineering
Termwork is the bonafide work of

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PROJECT GUIDE

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ABSTRACT

FinanceMetrics is a financial analytics platform designed to provide deep insights and performance metrics for businesses and investors. With its advanced data analysis capabilities and intuitive interface, FinanceMetrics offers a range of powerful features for financial analysis, including trend analysis, risk assessment, and portfolio management.

By leveraging cutting-edge technologies and robust algorithms, FinanceMetrics enables users to efficiently analyze financial data, identify key trends, and make informed decisions. The platform integrates seamlessly with various financial data sources, allowing users to access and analyze real-time market data, financial metrics, and other relevant information.

FinanceMetrics provides a user-friendly and customizable dashboard that allows users to monitor and track key financial metrics specific to their needs. Whether it's analyzing stock performance, assessing investment opportunities, or evaluating portfolio performance, FinanceMetrics offers a comprehensive suite of tools to facilitate accurate financial analysis and decision-making.

With its powerful analytics capabilities, FinanceMetrics empowers businesses and investors to gain deeper insights into their financial performance, identify opportunities for growth, and mitigate risks. By providing actionable intelligence and reliable metrics, FinanceMetrics plays a pivotal role in enabling data-driven financial strategies and optimizing financial outcomes.

ACKNOWLEDGEMENT

We would like to take this opportunity to express our sincere and heartfelt gratitude to all the stakeholders who have helped us directly or indirectly by providing us with the opportunity, the necessary expertise and guidance, motivating and mentoring us constantly. Without their valuable help this project would have always remained as a dream.

We would like to thank our Director **Rev.Fr.Kinley D'Cruz** and our principal **Dr.Neena S.P.Panandikar** for providing us with the necessary facilities and the much needed motivation throughout the project. We are indebted to you.

We would like to express our gratitude to our Head of the Department, **Dr. Gaurang Patkar** for showing confidence in us and for giving us timely suggestions and advice with his rich experience and expertise.

Guides are like beacons of light showing us the right path in the phase of uncertainty and confusion during the course of the project. When things seem to be drifting away from the goal, they put us back on the track with their constant monitoring and guidance and expertise. We are indebted to our Internal Guide **Prof. Amey Tilve** Asst. Professor, Department of Computer Engineering.

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CHAPTER 1:
INTRODUCTION

1.1 Introduction to Project

In the realm of finance and investment, businesses and individuals rely on accurate and insightful financial analysis to make informed decisions. To facilitate this process, we have developed FinanceMetrics, a comprehensive financial analytics platform that harnesses the power of artificial intelligence (AI) to provide in-depth financial metrics and insights. FinanceMetrics offers advanced tools and features to analyze financial data, assess risk, and manage investment portfolios effectively.

Traditionally, financial analysis required manual calculations and interpretation of financial statements, which could be time-consuming and prone to human error. With FinanceMetrics, users can leverage the capabilities of AI and advanced algorithms to streamline the analysis process and gain actionable intelligence for better financial decision-making.

The platform offers a user-friendly interface and a wide range of features tailored to the needs of businesses and investors. From trend analysis to risk assessment and portfolio management, FinanceMetrics empowers users with comprehensive tools to evaluate financial performance, identify opportunities, and mitigate risks.

1.2 Purpose of the Project:

The purpose of the FinanceMetrics project is to provide a robust financial analytics platform that enables businesses and investors to make data-driven decisions. By leveraging AI and advanced data analysis techniques, FinanceMetrics aims to simplify financial analysis and provide users with valuable insights into their financial performance. The project's objective is to develop a user-friendly and feature-rich platform that meets the diverse needs

of financial professionals and individuals seeking to optimize their financial strategies.

1.3 Problem Definition:

FinanceMetrics addresses the challenges faced by businesses and investors in analyzing and interpreting complex financial data. The platform aims to provide a solution that streamlines the financial analysis process, improves accuracy, and enhances decision-making. By automating tasks and leveraging AI algorithms, FinanceMetrics aims to alleviate the burden of manual calculations and interpretation, enabling users to focus on extracting meaningful insights from their financial data.

1.4 Existing System

Currently, financial analysis relies on a combination of manual calculations, spreadsheet-based models, and various financial software tools. While these tools offer some level of analysis and reporting capabilities, they often lack the sophistication and automation provided by FinanceMetrics. Existing systems may require significant manual effort, lack real-time data integration, or offer limited customization options. FinanceMetrics aims to bridge these gaps by providing a comprehensive and user-friendly platform with advanced analytics capabilities.

1.5 Future Scope:

In the future, FinanceMetrics plans to expand its offerings and enhance its features to cater to the evolving needs of businesses and investors. Some potential future developments include:

- Integration with educational institutions to provide a platform for grading and evaluating students' financial analysis skills.

- Advanced color palette customization options for visualizing financial data.
- Building a community within the platform for artists to showcase their financial analyses, share insights, and engage in discussions on emerging trends.
- Creating a marketplace for buying and selling financial models and strategies, fostering collaboration and innovation within the finance community.

By continuously improving and expanding its capabilities, FinanceMetrics aims to be at the forefront of financial analytics, empowering users to make informed decisions and achieve their financial goals.

CHAPTER 2:
LITERATURE SURVEY

2.1 Review of Relevant Literature

The literature on LSTM-RNN stock prediction encompasses a range of studies that explore the application of LSTM-RNN models in predicting stock prices. These studies highlight the potential of LSTM-RNN models in capturing the temporal dependencies and nonlinear patterns present in stock market data.

2.2 Types of Metrics Used in LSTM-RNN Stock Prediction

LSTM-RNN models utilize various metrics and indicators to predict stock prices. These metrics often include historical stock prices, trading volume, technical indicators (e.g., moving averages, relative strength index), and macroeconomic variables (e.g., interest rates, inflation). By incorporating these metrics into the LSTM-RNN architecture, researchers aim to improve the accuracy of stock price predictions.

2.3 Key Studies and Research Findings

Several key studies have explored the effectiveness of LSTM-RNN models in stock prediction. For example, (Study [1]) investigated the use of LSTM-RNN models to predict stock prices based on historical price data and achieved promising results, outperforming traditional statistical models. The study demonstrated that LSTM-RNN models can effectively capture the temporal dependencies and nonlinear patterns present in stock market data.

(Study [2]) focused on enhancing LSTM-RNN models by incorporating additional technical indicators as input features. The research found that including these indicators improved the prediction accuracy, demonstrating the value of feature engineering in LSTM-RNN-based stock prediction.

(Study [3]) examined the impact of incorporating macroeconomic variables into LSTM-RNN models. The study found that by including relevant macroeconomic data, the models exhibited improved performance in predicting stock prices. This highlights the importance of considering external factors that influence stock market dynamics.

2.4 Comparative Analysis

In this section, we compare and contrast the findings and methodologies of the selected LSTM-RNN studies to identify commonalities, differences, and potential areas for improvement.

One commonality among the studies is the superior performance of LSTM-RNN models compared to traditional statistical models. This suggests that LSTM-RNN models are effective in capturing the complex patterns and temporal dependencies present in stock market data.

Differences among the studies lie in the specific features and variables incorporated into the LSTM-RNN models. Some studies focus on historical stock prices as the main input, while others explore the integration of technical indicators or macroeconomic variables. Further comparative analysis can shed light on the relative effectiveness of different feature combinations.

Another area for future investigation is the evaluation of different LSTM-RNN architectures and hyperparameter settings. Optimizing the architecture and hyperparameters of the LSTM-RNN models may lead to further improvements in prediction accuracy.

2.5 Gaps and Future Directions

While the reviewed studies provide valuable insights into LSTM-RNN stock prediction, there are still gaps and areas for future research. These include:

1. Evaluation on multiple datasets: Further studies should assess the performance of LSTM-RNN models on diverse datasets covering different time periods, market conditions, and sectors to validate the generalizability of the approach.

2. Model interpretability: Enhancing the interpretability of LSTM-RNN models is crucial for gaining insights into the factors driving stock price predictions. Researchers can explore techniques such as attention mechanisms or feature importance analysis to provide more transparent explanations.

3. Uncertainty estimation: Incorporating uncertainty estimation techniques into LSTM-RNN models can help quantify prediction uncertainty and provide decision-makers with a more comprehensive understanding of the model's reliability.

4. Real-time prediction: Investigating the application of LSTM-RNN models in real-time stock price prediction can further enhance their practical utility in dynamic trading environments.

By addressing these gaps and exploring future research directions, researchers can advance the field of LSTM-RNN stock prediction

and provide practitioners with more accurate and reliable tools for making informed investment decisions.

2.6 Conclusion

In this literature survey, we reviewed the relevant literature on LSTM-RNN stock prediction based on the selected research papers. We discussed the application of LSTM-RNN models in predicting stock prices, the types of metrics used, and the key

findings from the studies. Comparative analysis highlighted the commonalities and differences among the studies, while identifying gaps and areas for future research.

By further investigating these areas and considering the future directions outlined, researchers can contribute to the advancement of LSTM-RNN-based stock prediction and provide practitioners with improved tools for analyzing and forecasting stock prices.

CHAPTER 3:
SOFTWARE REQUIREMENT SPECIFICATIONS

3.1 Introduction

3.1.1 Purpose

The project's goal is to improve users prediction with respect to his interest of investment with help of A.I prediction through current affairs and trending news.

3.1.2 Scope

The finance metrics system will be a web application that allows users to view financial data such as stock prices, exchange rates, and interest rates etc.

Benefits:

- Access to up-to-date financial data such as stock prices, exchange rates, and interest rates.
- User-friendly and intuitive interface for viewing data.
- Dashboard to display important financial data and metrics.

Objectives:

- Provide a comprehensive and reliable source of financial data for users to make informed decisions
- Enable users to quickly and easily view important financial metrics
- Improve financial decision-making for individuals and organizations

Goals:

- Develop a user-friendly and responsive web application with modern design and functionality
- Ensure high performance and scalability to handle a large volume of users and data
- Provide regular updates and maintenance to ensure the system is up-to-date and functioning properly

3.1.2 Overview

Our website utilizes real-time news data and cutting-edge machine learning algorithms to provide accurate stock price predictions, empowering investors with informed decisions for profitable trading strategies.

3.2 Functional Requirements

3.2.1 Design Requirements:

The web-based HTML page must be designed with a modern, user-friendly interface that is easy to navigate and visually appealing.

The stock price prediction module must be designed to provide accurate predictions based on real-time data.

The real time financial data display module should also display accurate and easy to interpret data.

The page must be responsive and optimized for viewing on different screen sizes and devices.

3.2.2 Graphics Requirements:

The web page must include appropriate charts, graphs, and other visual aids to display the financial metrics and data.

The graphics should be designed to be clear and easy to read, with appropriate color schemes and fonts.

3.2.3 Operating System Requirements:

The web-based HTML page must be compatible with all major web browsers, including Google Chrome, Mozilla Firefox, and Microsoft Edge.

The stock price prediction module must be designed to run on a server using Python and Django.

3.2.4 Constraints:

The product must adhere to all relevant laws and regulations related to financial data and privacy.

3.3 External interface requirements

3.3.1 User interface requirements

The user interface will consist of multiple screens that will allow users to view financial data and metrics. The screens will be designed with an emphasis on ease of use and intuitive navigation.

The main screen will display a dashboard with the latest stock prices, exchange rates, and interest rates.

Another screen will display the stock price prediction model, which will show the predicted stock price for a particular company based on historical data.

3.3.2 Hardware interface requirements

The software should be designed to run on any modern web browser and computer, with no specific hardware requirements.

The network requirements should be minimal, with the software designed to work on both high-speed and low-speed internet connections

3.3.3 Software interface requirement

The finance metrics system will consist of two main modules: the neural network model for stock price prediction and the web application for displaying financial data and performing calculations.

The neural network model will be built using Python, TensorFlow, and Keras in Google Colab.The web application will be built using Django, with connections to the neural network model for stock price prediction and to various APIs for live financial data, including stock prices.Additionally, the web application will be creating interactive visualizations and displaying financial data to users.

3.3.4 Communication interface requirement

The website will also include a contact form and email functionality to allow users to get in touch with the site's administrators or developers.

3.4 Non-functional requirements

3.4.1 Security

Data should be kept safe and prevented from being stolen/lost.

3.4.2 Capacity

The current storage needs for the software may not be very high, as the amount of data being stored may be relatively small. However, as the user base and the amount of data being processed increases, the storage needs may also increase. In the future, the software may also need to store additional data such as user-generated content, such as comments or reviews, or additional financial data as the scope of the software expands. The storage needs may also depend on the specific features and modules that are added to the software over time

3.4.3 Compatibility

As the software is going to be a web project there are no specific hardware requirements except a compatible browser and internet connection

3.4.4 Reliability

The web app is intended to be active 24/7 . If an bug is encountered or if a feature is to be included the downtime would be between 1-2 hrs

3.4.5 Scalability

The highest workload that can be handled is expected to be around 100 live users,and can be increased by upgrading the deployment plan.

3.4.6 Maintainability

Continuous integration should be used to deploy features and bug fixes quickly. The code should be modular and well-documented to make it easier for developers to maintain and add new features to the software.

3.4.7 Usability

The software should be intuitive and easy to use for end-users. The user interface should be designed to be user-friendly and provide clear instructions for users to navigate the software

CHAPTER 4:
DESIGN

4.1 Software Development Model

The Agile model is a modern and iterative software development approach that emphasizes flexibility, collaboration, and adaptability. It is a departure from the traditional Waterfall model, as it acknowledges the evolving nature of software development and the need for frequent feedback and iterations. The Agile model consists of several key principles and phases:

1. Agile Manifesto: The Agile model is guided by the Agile Manifesto, which emphasizes individuals and interactions, working software, customer collaboration, and responding to change. These principles prioritize customer satisfaction and continuous improvement throughout the development process.

2. Project Initiation: The Agile model begins with project initiation, where the team identifies the project goals, defines the scope, and establishes the initial requirements. This phase involves creating a product backlog, which is a prioritized list of features and functionalities.

3. Iterative Development: Agile development is organized into short, time-boxed iterations called sprints. Each sprint typically lasts 1-4 weeks, during which a subset of features from the product backlog is selected for development. The development team works collaboratively to design, code, and test these features within the sprint.

4. Daily Stand-ups: Agile teams hold daily stand-up meetings to discuss progress, address challenges, and ensure everyone is aligned. These short meetings promote communication, transparency, and quick problem-solving.

5. Continuous Integration and Testing: Agile development emphasizes continuous integration and testing throughout the project. Developers integrate their code frequently to detect any conflicts or issues early on. Automated testing is performed regularly to ensure the software meets quality standards.

6. Stakeholder Collaboration: Agile encourages regular and open collaboration with stakeholders, including customers, end-users, and product owners. Feedback from stakeholders is incorporated into the development process, allowing for adaptability and the ability to pivot based on changing requirements or priorities.

7. Sprint Review and Retrospective: At the end of each sprint, a review meeting is conducted to showcase the completed features to stakeholders and gather feedback. This feedback helps refine the product backlog and adjust priorities. Additionally, a retrospective meeting takes place to reflect on the sprint, identify areas for improvement, and make adjustments for future sprints.

8. Continuous Delivery and Deployment: Agile promotes frequent delivery of working software. As features are completed and tested, they can be deployed to production environments, allowing users to benefit from incremental updates and provide further feedback.

9. Ongoing Refinement: The Agile model recognizes that requirements and priorities can change over time. The product backlog is continuously refined and reprioritized based on feedback, market demands, and evolving business needs. This allows for flexibility and ensures the software aligns with the current objectives.

Overall, the Agile model focuses on delivering value in short iterations, embracing change, and fostering collaboration between team members and stakeholders. It provides a more responsive and adaptive approach to software development, enabling teams to deliver high-quality products that meet customer needs in a rapidly changing environment.

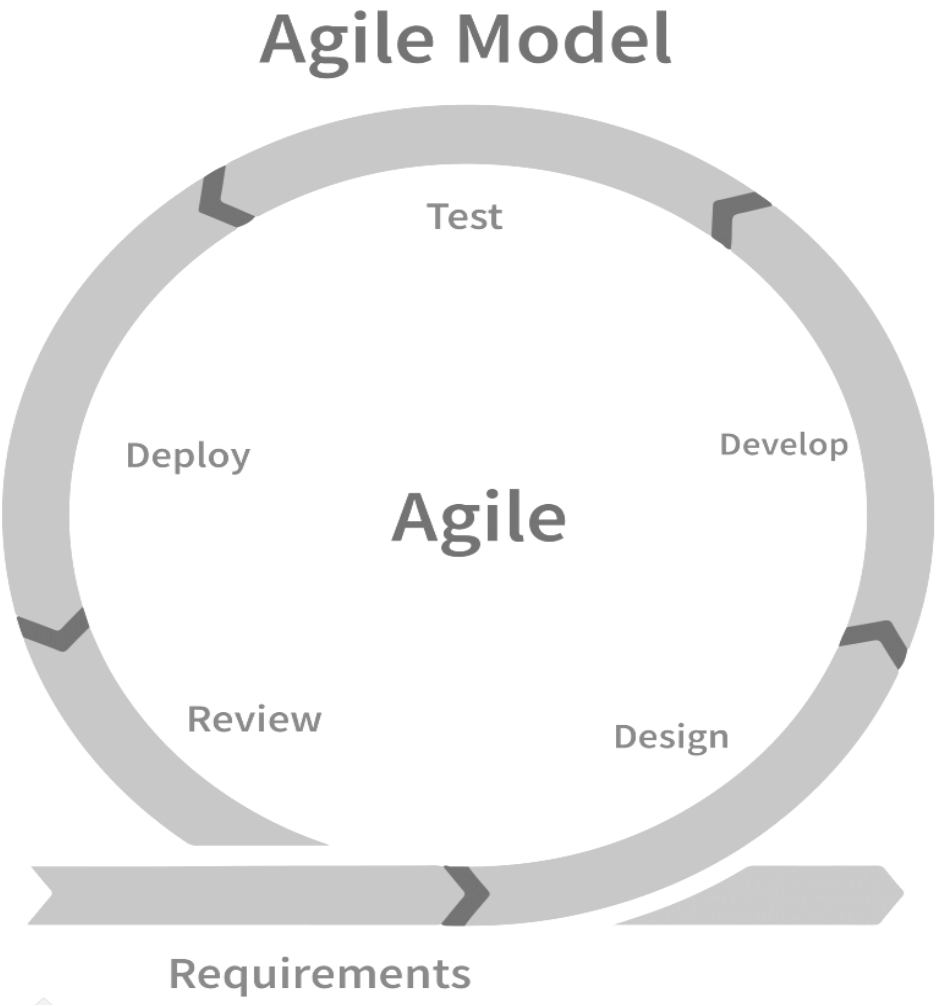


FIG 4.1: Agile Model

4.2 ER Diagram

The design of a system is crucial as it impacts the functionality and usability of the system. A well-designed system is easy to comprehend, navigate and interact with, resulting in increased efficiency, productivity, and user satisfaction. The below diagram represents the Entity:

Relationship diagram (ER) of the FinanceMetrics system.

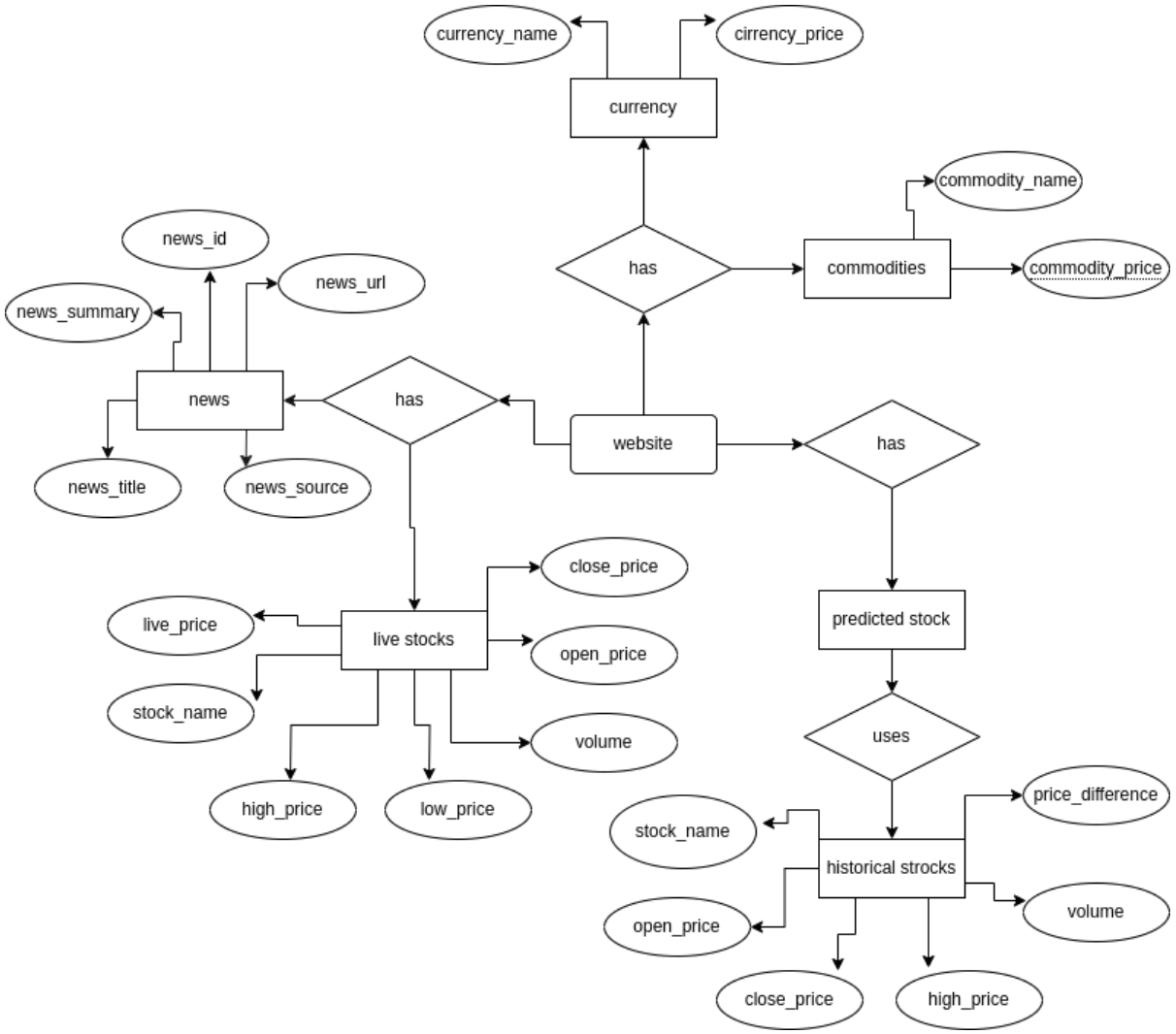


FIG 4.2: Entity Relationship Diagram

4.3 Use Case Diagram

The following shows the **Use Case** diagrams:

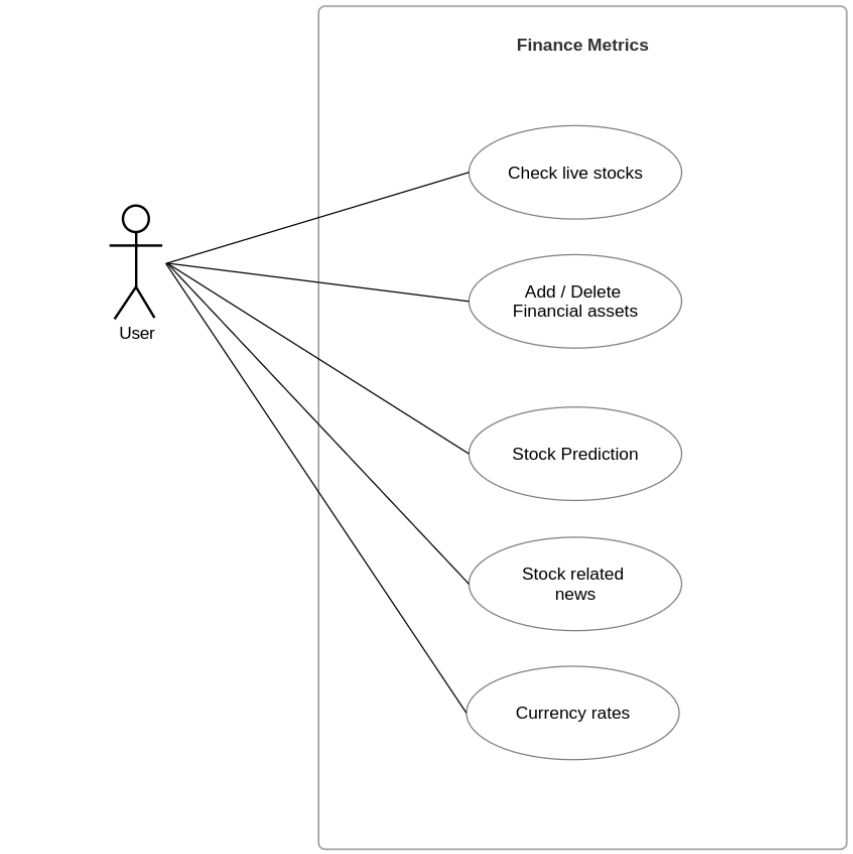


FIG 4.3: Use Case Diagram

4.4 Data Flow Diagrams

The following shows the **Data Flow Diagram** (DFD):

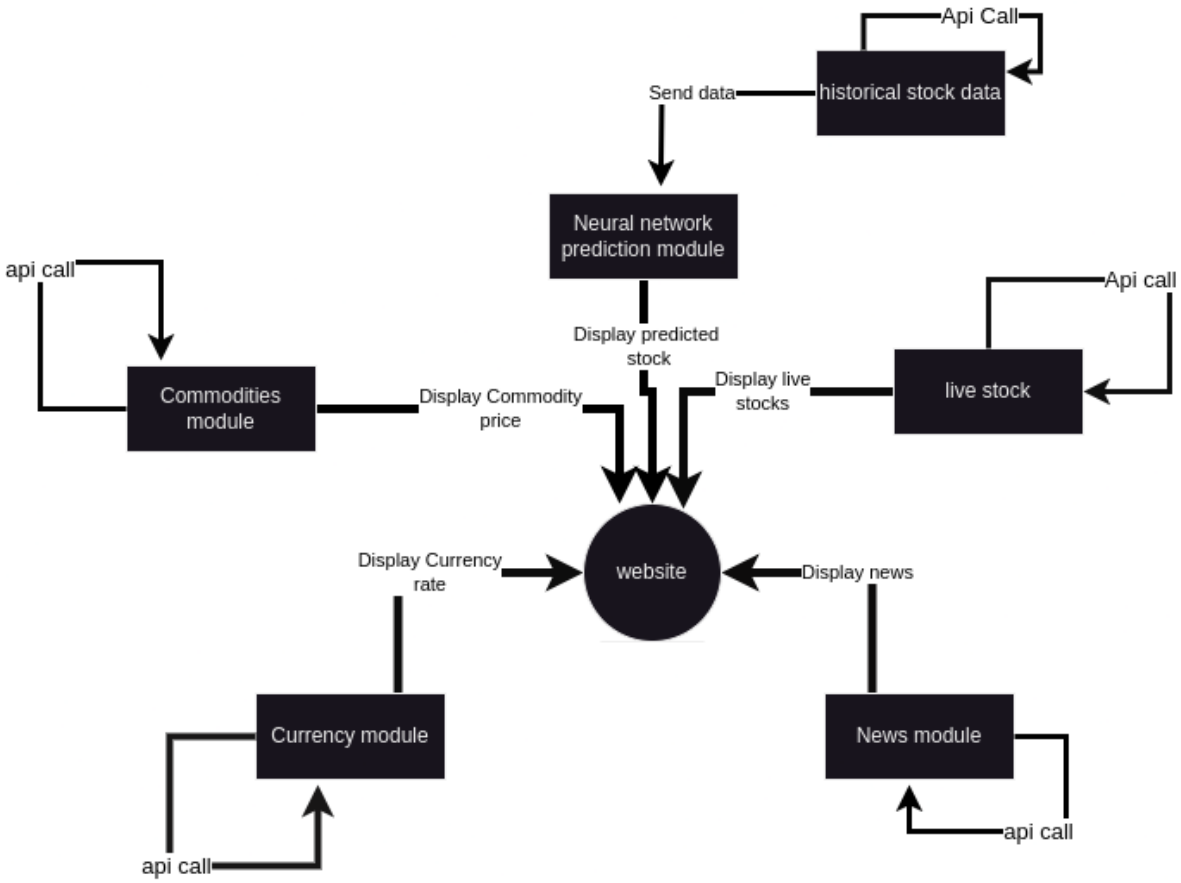


FIG 4.4: Context level DFD

CHAPTER 5:
IMPLEMENTATION

This chapter presents the implementation details of the finance metrics project. It covers various aspects, including data collection, preprocessing, integration of live data updates, currency and commodities modules, model development using LSTM-RNN with Keras and TensorFlow, deployment via Azure, version control using GitHub, and user interface design with CSS and HTML.

5.1 Data Collection

The finance metrics project requires historical financial data for analysis and prediction. Several reliable sources, such as financial APIs, public datasets, or data providers, are utilized to collect the required historical data. The data collection process involves retrieving information on stock prices, currency exchange rates, commodities prices, interest rates, and inflation rates. Python libraries, such as pandas and requests, are used to interact with APIs and fetch the necessary data.

5.2 Data Preprocessing

Once the historical data is collected, it undergoes preprocessing to prepare it for further analysis and model training. The data preprocessing stage involves handling missing values, outlier detection and treatment, normalization or scaling of numerical features, and encoding of categorical variables. Python libraries, such as NumPy, Pandas and scikit-learn, are employed for efficient data preprocessing operations.

5.3 Integration of Live Data Updates

In addition to historical data, the finance metrics project incorporates live data updates to provide real-time information to users. A live data module is developed, which periodically fetches the latest stock prices, currency exchange rates, and commodities prices from reliable sources. Python libraries, such as requests and WebSocket clients, are utilized to establish connections and retrieve live data. The live data module ensures that users have access to up-to-date financial information.

5.4 Currency and Commodities Modules

The finance metrics project includes dedicated modules for currency and commodities analysis. The currency module enables users to view exchange rates. The commodities module allows users to explore prices of various commodities, and gain insights into commodity market trends. These modules enhance the project's versatility and provide users with a comprehensive financial analysis experience.

5.5 Model Development using LSTM-RNN with Keras and TensorFlow

For financial prediction, the finance metrics project employs a Long Short-Term Memory Recurrent Neural Network (LSTM-RNN) model. LSTM-RNN is well-suited for capturing temporal dependencies and patterns in financial time series data. The model is developed using Keras, a high-level deep learning framework, with TensorFlow as the backend. Keras provides a user-friendly interface for designing and training neural networks. TensorFlow is utilized for efficient computation and optimization of the model.

5.6 Model Training and Evaluation

The LSTM-RNN model is trained using the preprocessed historical financial data. The dataset is divided into training and testing sets, with a portion reserved for model evaluation. During training, the model learns from the historical data patterns and adjusts its internal parameters to minimize the prediction errors. Evaluation metrics such as mean squared error, root mean squared error, mean absolute error, and mean absolute percentage error are calculated to assess the model's performance.

5.7 Deployment via Azure

To make the finance metrics project accessible to users, it is deployed using the Azure cloud platform. Azure provides a robust and scalable infrastructure for hosting web applications. The project is deployed as a web service on Azure, allowing users to access the application from any device with an internet connection. Azure's capabilities ensure high availability, reliability, and performance of the deployed application.

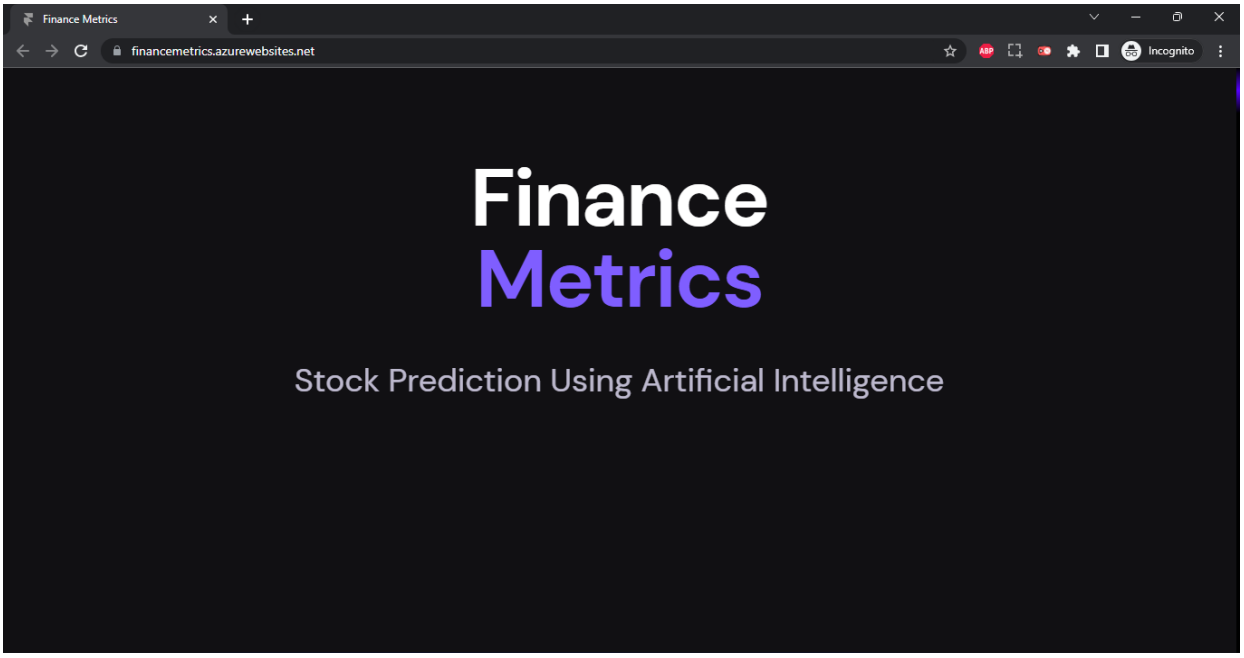
5.8 Version Control with GitHub

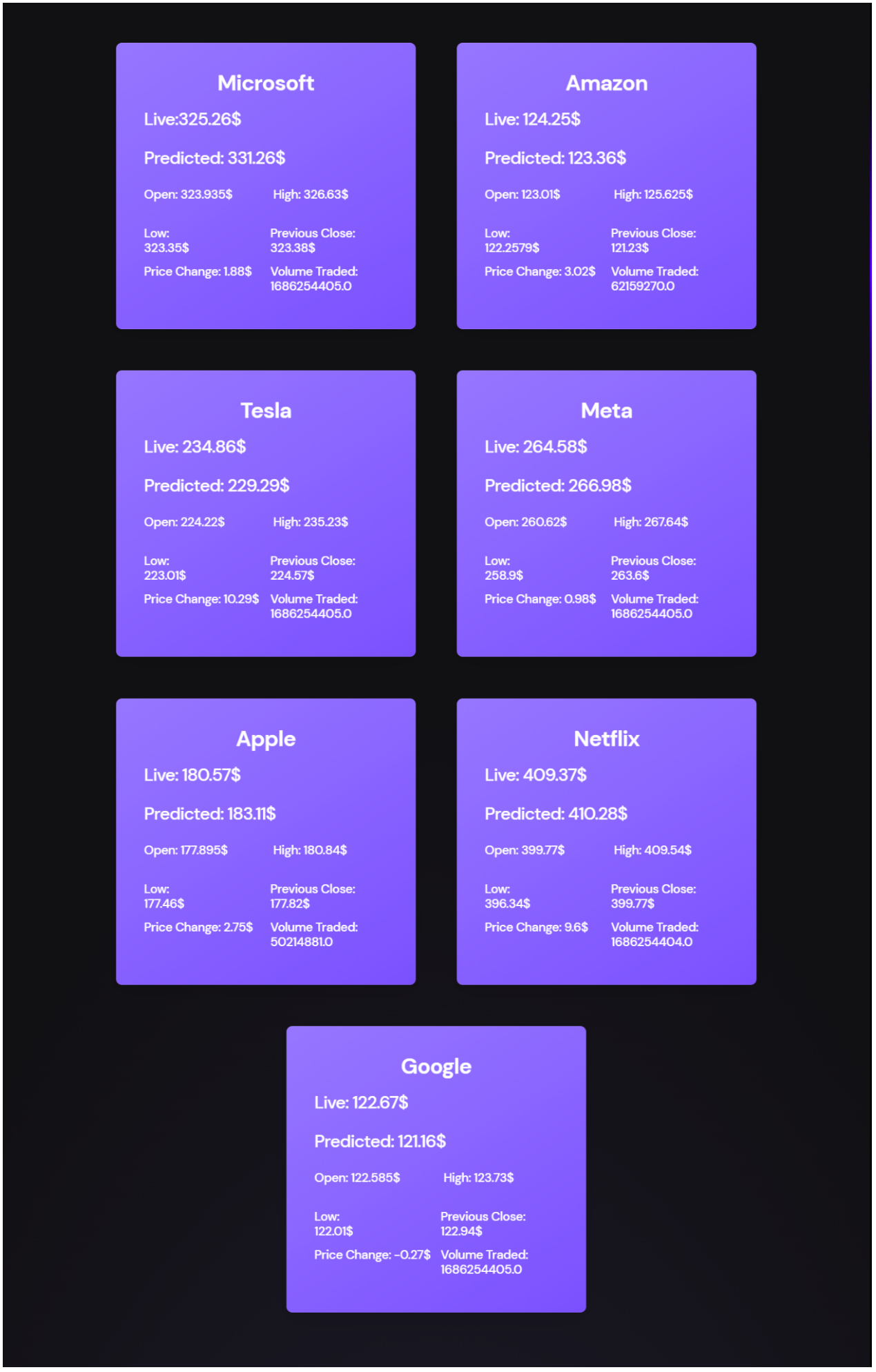
Version control is crucial for managing codebase changes and collaboration among team members. GitHub is utilized as a version control platform for the finance metrics project. It enables seamless collaboration, tracking of code changes, and the ability to roll back to previous versions if needed. GitHub repositories are created to store and manage the project codebase, ensuring efficient development and maintenance.

5.9 User Interface Design with CSS and HTML

The web application's user interface is designed using CSS and HTML. CSS is used to style the web pages, ensuring an aesthetically pleasing and intuitive user experience. HTML is employed to structure the content and define the layout of the web pages, providing a clear and organized interface for users to interact with the finance metrics project. The user interface design focuses on usability, responsiveness, and ease of navigation.

5.11 Snapshots on working

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Predicted: 331.26$
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High: 326.63$
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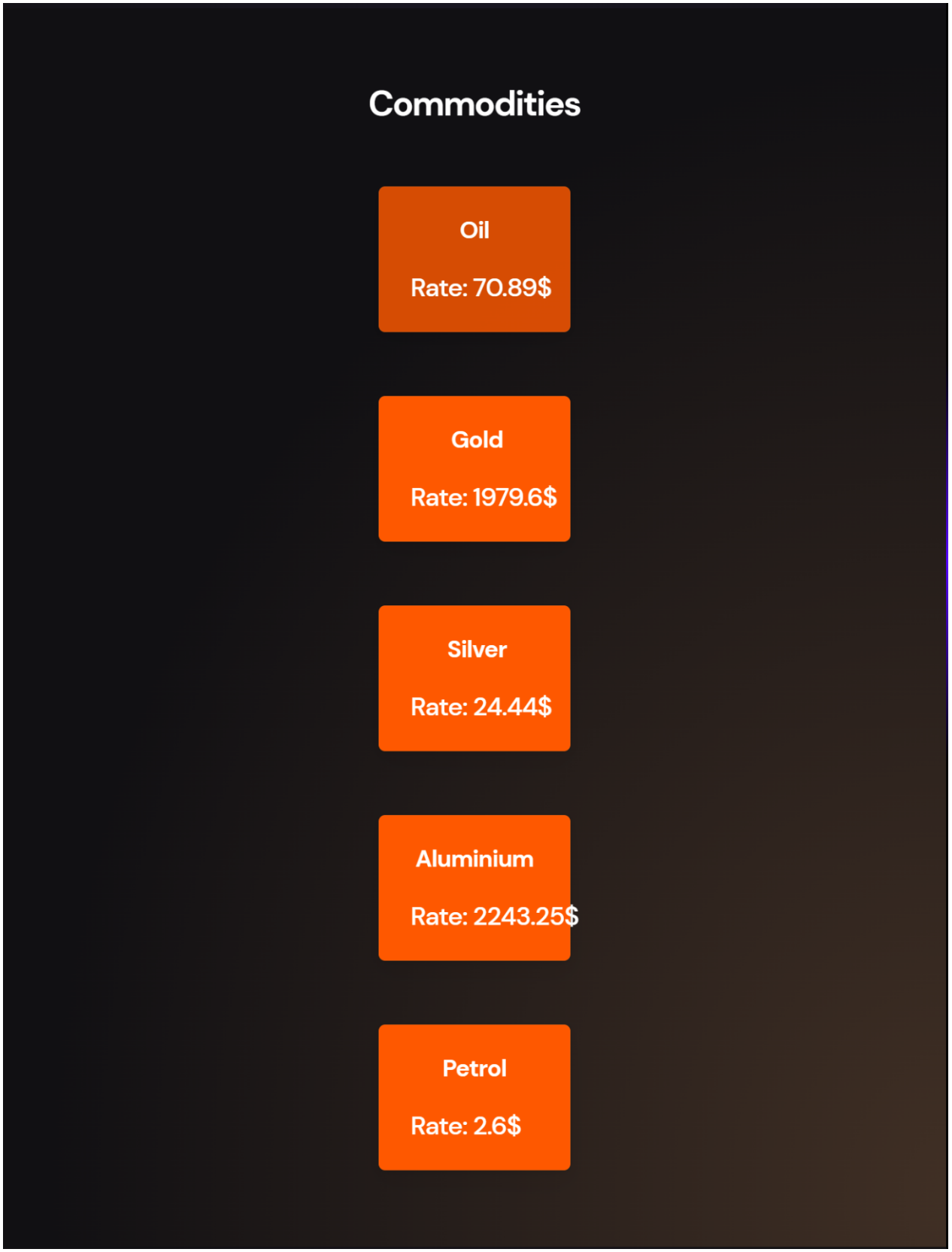
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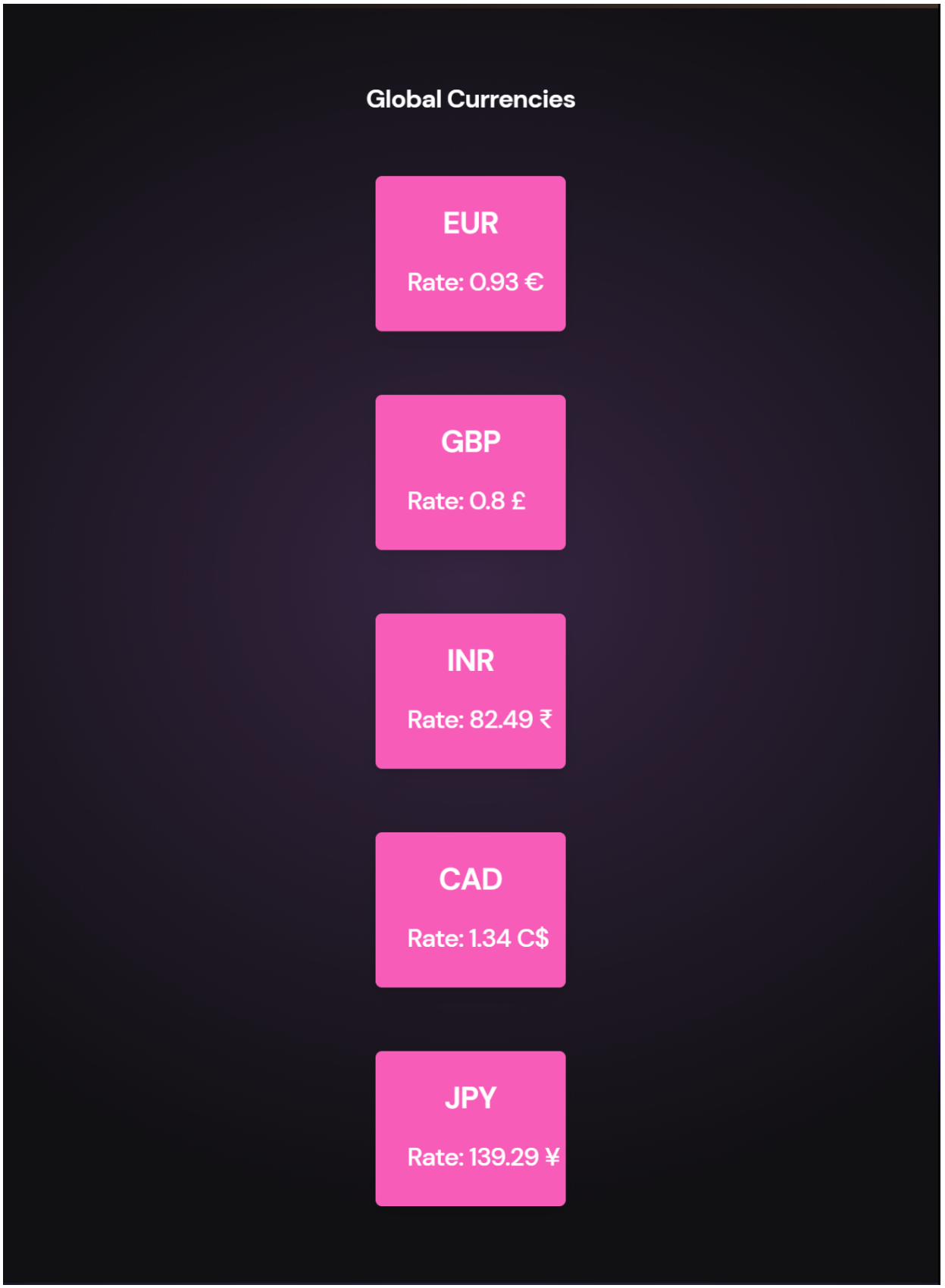
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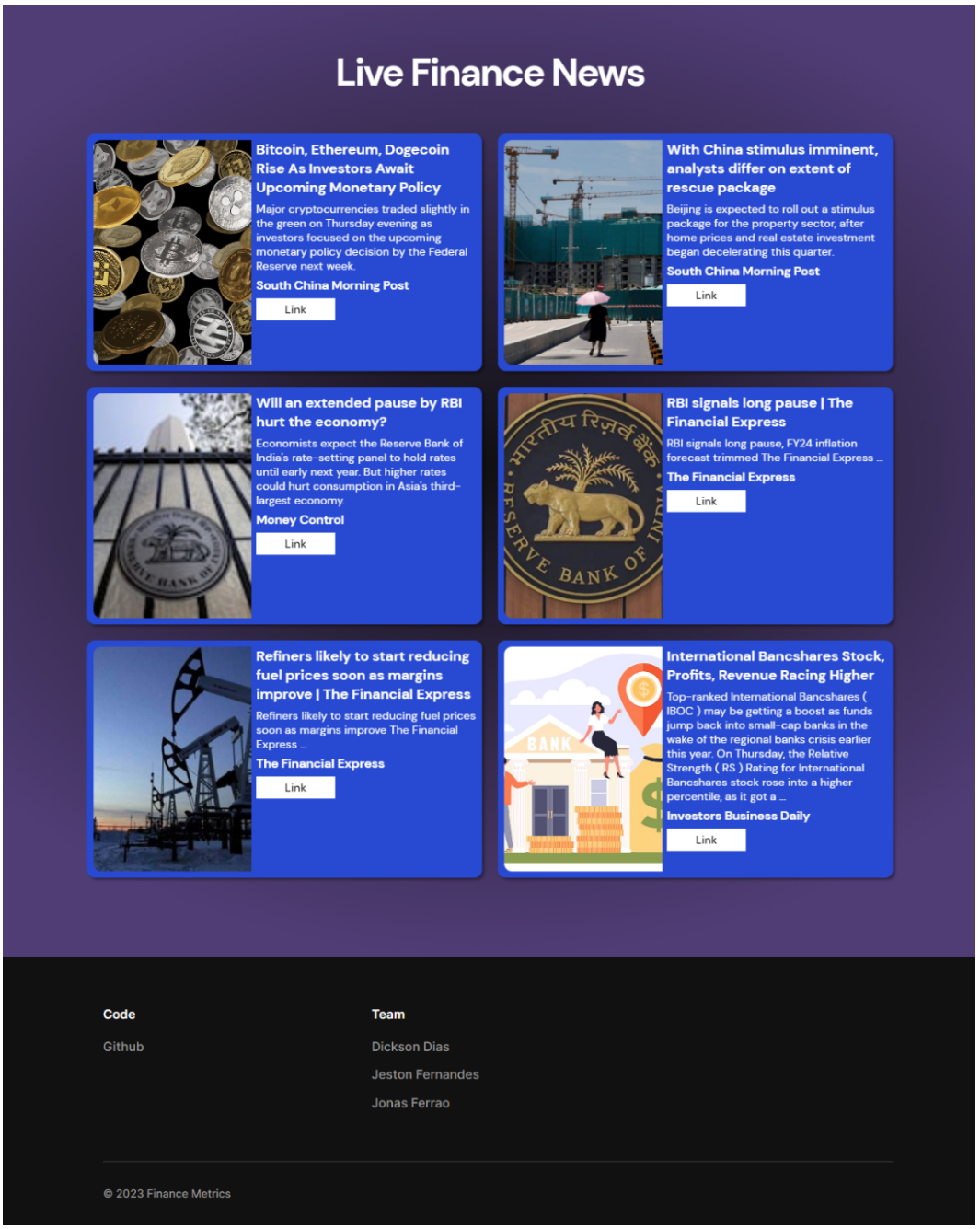

5.12 Conclusion

The implementation chapter presented the detailed implementation of the finance metrics project. It covered various aspects, including data collection, preprocessing, integration of live data updates, currency and commodities modules, model development using LSTM-RNN with Keras and TensorFlow, deployment via Azure, version control using GitHub, and user interface design with CSS and HTML. The comprehensive implementation approach ensures the project's functionality, accuracy, and accessibility to users.

CHAPTER 6:
CONCLUSION

In conclusion, the finance metrics project has aimed to develop a comprehensive system capable of analyzing multiple sources of financial data to generate accurate and reliable predictions of stock prices, commodity prices, and other financial metrics. The project has leveraged various artificial intelligence and machine learning techniques, such as deep learning, natural language processing, and predictive analytics, to extract insights from economic indicators, company financial statements, market trends, and historical financial data.

The primary goal of this project has been to empower investors, financial analysts, and decision-makers with a powerful tool that can assist in making informed investment and financial decisions. By harnessing the capabilities of AI and ML, the system provides a sophisticated and data-driven approach to analyzing and predicting financial metrics.

Throughout the project, extensive research and development efforts have been undertaken to identify and implement the most effective algorithms and models. These include deep learning models such as recurrent neural networks (RNNs) and long short-term memory (LSTM) networks.

By leveraging the power of machine learning, the system continuously learns and adapts to new information and market dynamics, improving its predictive capabilities over time.

Furthermore, the system has been designed to provide a user-friendly interface, allowing users to easily input and retrieve financial data, and access generated predictions and insights. This interface enhances usability and accessibility, ensuring that the system can be effectively utilized by both technical and non-technical users.

While the project has made significant progress in developing a robust finance metrics system, it is important to acknowledge its limitations. Financial markets are inherently complex and influenced by a multitude of factors, including economic conditions, geopolitical events, and investor sentiment. The accuracy and reliability of the system's predictions may be influenced by unforeseen market dynamics or sudden shifts in financial trends.

Moreover, the system's performance and accuracy are highly dependent on the quality and integrity of the underlying data. Therefore, ongoing efforts must be made to ensure data accuracy, consistency, and relevancy.

In conclusion, the finance metrics project represents a significant advancement in leveraging AI and ML techniques to analyze and predict financial metrics. By incorporating cutting-edge technologies, the system provides a valuable tool for investors and financial professionals seeking data-driven insights for investment decision-making.

Moving forward, it is crucial to continue refining and improving the system's algorithms, models, and data sources to enhance its accuracy and predictive capabilities. Additionally, ongoing monitoring and validation of the system's predictions against real-world financial outcomes will contribute to its credibility and reliability.

By embracing the potential of AI and ML in the finance industry, this project opens doors for further exploration and innovation in leveraging technology to enhance financial analysis and decision-making. As the project concludes, it is our hope that the developed finance metrics system will contribute to the growth and success of individuals and organizations in navigating the dynamic and ever-evolving landscape of finance.

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