RSET
RAJAGIRI SCHOOL OF
ENGINEERING & TECHNOLOGY
(AUTONOMOUS)

Project Report On

Financial Strategy Application

Submitted in partial fulfillment of the requirements for the award of the degree of

Bachelor of Technology

in

Computer Science and Engineering

By

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CERTIFICATE

This is to certify that the project report entitled ***"Financial Strategy Application"*** *is a bonafide record of the work done by* ***By Ryan Thomas (U2103186), Nithin John (U2103160), Thomas T. Thayyil (U2103210)*** *submitted to the Rajagiri School of Engineering & Technology (RSET) (Autonomous) in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology (B. Tech.) in "Computer Science and Engineering" during the academic year 2024-2025.*

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Abstract

MoneyMaster is an all-encompassing financial strategy application crafted to deliver personalized insights and recommendations to both novice and seasoned investors. The platform features a homepage that provides real-time updates on financial news and trending investments, akin to leading financial websites. MoneyMaster contains a personalized financial advisor to obtain tailored financial guidance depending on the user's income, expenditure and behavior while using the application. Users can regenerate advice per their own preferences for dynamic personalized support. MoneyMaster's distinguishing feature is its AI-powered stock prediction, which estimates market trends by analyzing historical data and key indicators. This allows users to make data-driven investment decisions with increased confidence. Moreover, the platform includes a robust fraud detection system created to protect against insider trading, embezzlement and other dubious activities. For example, if a user discloses potential insider information in the chatbox, the system will alert them and adjust recommendations accordingly. To support users' decision-making, MoneyMaster offers a ticker-based article summarizer that organizes and summarizes relevant business news based on the stock name entered by the user, helping investors quickly spot opportunities and risks associated with their portfolios. By integrating tailored financial guidance, sophisticated stock forecasts, and secure fraud oversight, MoneyMaster acts as the perfect partner for navigating today's complex financial markets.

Contents

List of Abbreviations

LSTM - Long Short-Term Memory

BiGRU - Bidirectional Gated Recurrent Unit

RMSE - Root Mean Squared Error

MSE - Mean Squared Error

R^2 - Coefficient of Determination

BERT - Bidirectional Encoder Representations from Transformers

F1-Score - F1 Measure (Harmonic mean of precision and recall)

CNN - Convolutional Neural Network

RNN - Recurrent Neural Network

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Chapter 1

Introduction

1.1 Background

The financial market has consistently been a complicated and ever-changing arena, necessitating individuals to make educated decisions to realize their financial aspirations. Nevertheless, the overwhelming amount of financial information and the swift rate of market changes can frequently intimidate investors, especially those unfamiliar with the field. Artificial intelligence has transformed the realm of investing, providing investors with tools and resources to optimize the enhancement of their wealth like never before. By utilizing AI-driven modules, MoneyMaster intends to assist investors from every background with the knowledge to make well-informed choices to enhance their wealth.

1.2 Problem Definition

The biggest challenge for investors today is the lack of thorough and perfectly tailored financial advice. Inexperienced investors often find the financial landscape intimidating and require tools and utilities that simplify complex financial concepts while remaining trustworthy and accurate. MoneyMaster attempts to fill those gaps by offering customized investment suggestions through a very friendly chatbox, using AI-driven stock prediction to help its users make better decisions, a robust fraud-detection mechanism that guards against any possible threats that may arise from fraudsters, and summarizing relevant financial news to enhance decisions and identify opportunities.

1.3 Scope and Motivation

1.3.1 Scope

MoneyMaster is to be designed to serve as all-in-one application for financial advice consisting of a range of utilities such as:

- Dynamic home page with the latest market insights financial updates, stock charts and trending investments.
- Chatbox designed to replicate a conversational exchange of information similar to how human financial advice champion would communicate with an investor
- AI-powered stock price prediction engine
- Fraud detection to alert users of suspicious activities such as insider trading.
- An article summarizer to condense and categorize business news relevant to user portfolios.

1.3.2 Motivation

The rationale behind MoneyMaster is the increasing complexity of financial markets together with the growing demand of accessible, reliable, and personalized financial tools. MoneyMaster through AI and machine learning aims to provide actionable insights specifically tailored to their financial goals for its users and reduce the intimidation factor among novice investors through clear, step-by-step guidance while building trust and security around financial decision-making through mechanisms of fraud detection. It also brings about less complexity in tracking, analysis, and response to market trends.

1.4 Objectives

The primary objectives of MoneyMaster are:

1. Create an AI-driven financial application that offers customized investment guidance suited to personal requirements.
2. Integrate sophisticated algorithms for stock forecasting to evaluate market trends precisely by extrapolating the existing stock prices.

3. To implement a strong fraud detection system for the security of users.
4. To offer a dynamic and user-friendly interface for seamless interaction.
5. To Improve Decision Making Through a Real-time Article Summarizer That Identifies opportunities and risks and classifies them according to positivity.

1.5 Challenges

Developing MoneyMaster presents several challenges, including:

- Guaranteeing the precision and dependability of AI-based stock forecasts.
- Designing an intuitive user interface that accommodates both inexperienced and seasoned users.
- Incorporating an effective fraud detection system that can identify subtle and complex financial risks.
- Collecting, organizing, and summarizing financial news in a manner that delivers meaningful insights without overwhelming the user.

1.6 Assumptions

The project assumes:

- Users will be inclined to provide precise financial information for tailored recommendations.
- The dataset employed to train the stock prediction algorithms is extensive and reflective of actual market trends.
- Users will recognize that MoneyMaster is designed to be a decision support tool and not a substitute for professional financial guidance.

1.7 Societal and Industrial Relevance

MoneyMaster is highly pertinent in the current financial environment. For individuals, it provides a useful resource to manage the intricacies of investing, promoting financial

knowledge and autonomy. Within the finance sector, the application aligns with the increasing popularity of AI-based solutions, fulfilling the demand for clear, dependable, and effective decision-support frameworks. By connecting technology with finance, MoneyMaster plays a role in the wider goal of making financial intelligence accessible, enabling users from various backgrounds to confidently reach their financial objectives.

1.8 Organization of the Report

This report is structured to provide a comprehensive overview of the development and implications of an AI-driven financial advisory and stock prediction system. The report begins with an Introduction, covering the background, problem statement, scope, objectives, challenges, and societal relevance of the project.

A Literature Survey follows, reviewing related works in financial prediction systems and AI-driven tools while identifying gaps that the proposed system addresses. The System Design and Methodology chapter details the framework, tools, and techniques used, with a focus on hybrid AI models like LSTM-BiGRU and BERT-based analysis. The Implementation and Experiments chapter outlines the datasets, experimental setup, and the development process.

The Results and Discussion chapter evaluates the system's performance, comparing it with existing approaches, while a discussion of Challenges and Limitations addresses the obstacles encountered and areas for improvement. Finally, the Conclusion and Future Work summarizes findings, contributions, and potential directions for further development, followed by a comprehensive list of References.

1.9 Conclusion

This chapter aims at sharing results of the main observations and conclusions of the project. The high-power artificial intelligence technologies, the MoneyMaster application provides real end possibilities in helping users make right decisions especially in the financial aspects. By integrating features such as chatbot, stock prediction, fraud analytic and alerting system based on Artificial Intelligence. Article Summarizer: To so, yet one more assistance offers an combined answer to both new entrants and seasoned people. To guarantee that the users of the website get accurate and practical recommendations

that will solve their problems, the chatbot has two levels: Beginner and Advanced. Also, using real time updates, the calculative model of personalized investment portfolios and fraud detection, added utility and reliability to the platform. The project is able to successfully respond to the problem area of developing effective and efficient delivery of easy to understand yet sound and safe financial advice. MoneyMaster is trustworthy because it provides users with individual reports and also has high protection against fraud. However, it highlighted few recommendations where the current platform has some scope viz. to improve, with relation to further improvement in the predictive models, improving the efficiency of the fraud detection, and broadening the range of service provisions. More advances will be devoted to these enhancements so that MoneyMaster can sustain a well-innovated approach of addressing intricate global financial markets.

Chapter 2

Literature Survey

2.1 SMP-DL: A Novel Stock Market Prediction Approach Based on Deep Learning

2.1.1 Introduction

The study carried out by Shaban et al. [1] introduces the SMP-DL framework, a combined model created to address the complexities of forecasting stock market movements. Conventional methods often encounter a number of challenges due to the noisy, non- linear, and unstable nature of stock market information. SMPDL is keen on improving prediction accuracy by integrating the functionalities of Long Short Term Memory (LSTM) networks with Bidirectional Gated Recurrent Units (BiGRUs), which are time-series specific. The improvement is evident on its ability to capture both historical and future dependencies of stock sequences. By means of preprocessing data normalizing and feature selection, SMP-DL makes sure that the model only concentrates on the right patterns. It is therefore the best methodology for predicting the closing prices of stocks and ensuring that the model provides useful guidelines for decision-making using data by investors.

2.1.2 Methodology

The SMP-DL system operates through two main stages: data preprocessing and prediction. During the preprocessing stage, the data is cleansed and normalized, which guarantees the removal of noise and missing values. Feature selection is performed to pinpoint essential indicators that significantly influence stock movements. It uses a hybrid LSTM BiGRU model for forecasting. It boasts advantages from both model architectures. It has the ability to remember long-term dependencies, efficiently recognizing patterns at varying time intervals. However, BiGRU enhances this by providing a bidirectional per-

spective of the sequence, allowing the model to use not just contextual information on an earlier data point, but subsequent information points. The design of the SMP-DL model is elaborated on in Figure 2. 1. The model has been trained on past stock data and refined using different kinds of loss functions, including the Mean Squared Error (MSE). The evaluation metrics employed for this analysis consist of RMSE, MSE, and R2, and based on these metrics, the SMP-DL model surpassed the conventional ones concerning accuracy and strength. Figure 2.1 illustrates the architecture of the SMP-DL model.

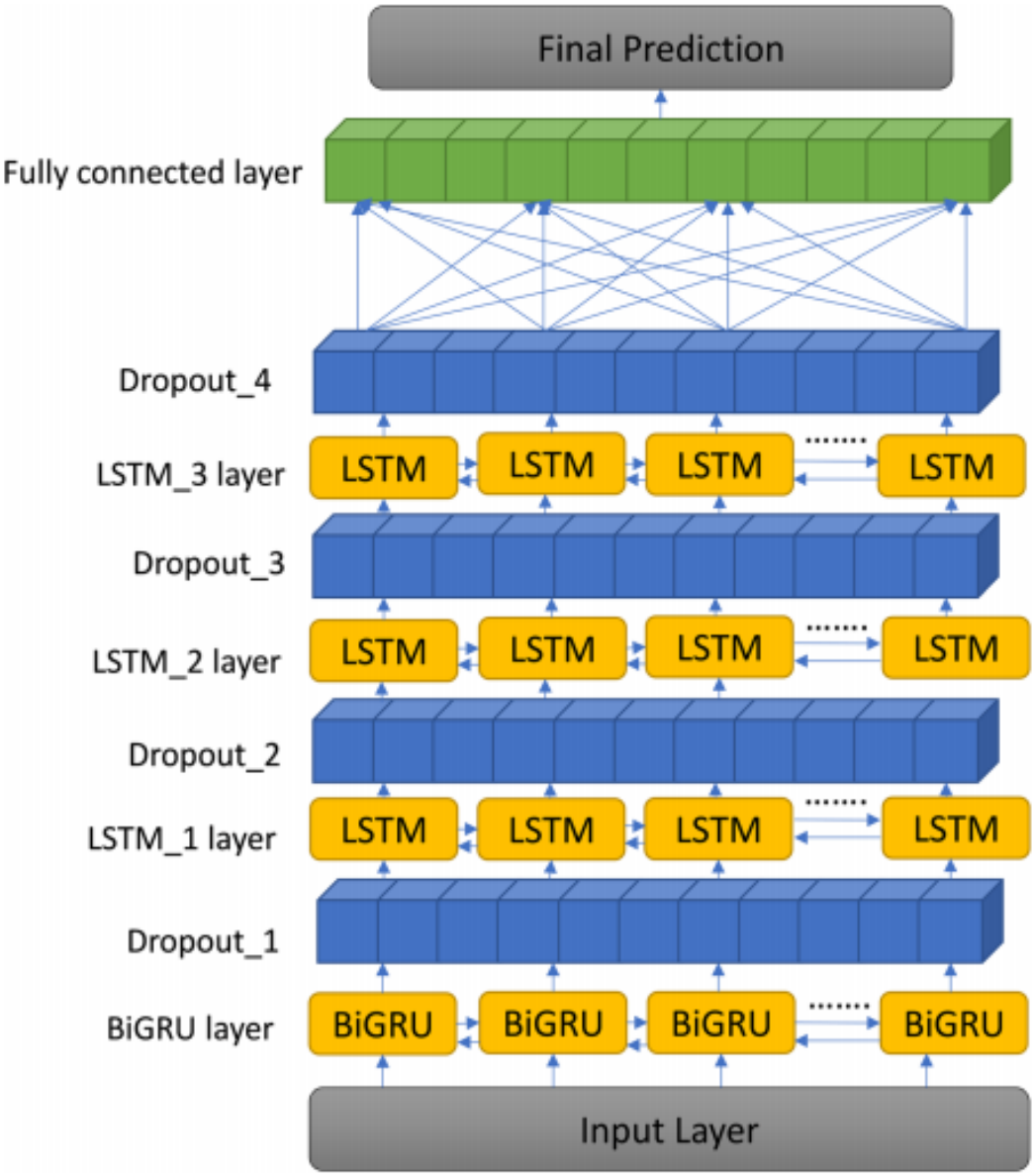


Figure 2.1: SMP-DL Architecture: Hybrid LSTM-BiGRU Model.

The system was trained on historical stock data and optimized using loss functions such

as Mean Squared Error (MSE). Evaluation metrics like RMSE, MSE, and R^2 were used to assess model performance, demonstrating superior accuracy and robustness compared to traditional techniques.

2.1.3 Results

The findings indicate that SMP-DL reaches impressive accuracy, with RMSE, MSE, and R2 values of 0. 2883, 0. 0831, and 0. 9948, respectively. While it has its benefits, LSTM's propensity to overfit and BiGRU's longer training period are mentioned as drawbacks.—

2.2 A BERT Framework for Sentiment Analysis of Tweets

2.2.1 Introduction

Bello et al. [2] describe an approach to categorize financial tweets based on sentiment analysis using Bidirectional Encoder Representations from Transformers (BERT). For understanding market trends and behavioral characteristics of investors, financial sentiment analysis is an irreplaceable tool, oftentimes derived from the unstructured and noisy sources such as social media. The architecture concentrates on context in ensuring correct interpretation of tweets for sentiment classification. Domain-based informal language, abbreviations, or unclear meanings make it more important for BERT to be fine- tuned to specific financial datasets. By extracting sentiment, the real-time data could potentially take into account significant factors that might influence stock price changes.

2.2.2 Methodology

The BERT-frame begins with deep data preprocessing: tokenization, normalization, tweet preparation for analysis, and so forth. Then, the fine-tuning of the BERT model constitutes using the labeled financial datasets, which would allow it to grasp further the specifics of modeling for that unique lexicon of financial terminology. In order to enhance predictive accuracy, the framework integrates supplementary layers such as Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), and Bidirectional Gated Recurrent Units (BiGRU). These layers augment the contextual representations generated by BERT, thereby improving the model's proficiency in comprehending relationships within the data.

Figure 2. 2 shows the architecture of the BERT-based sentimental analysis framework. The system is assessed through standard metrics for sentiment analysis achieving accuracy and F1-scores, reflecting the efficiency of effective classification of financial sentiments. However, the system is limited due to its dependence on a large set of data and high computational resources, thus making it a challenge for implementation in resource-scare environments.

Figure 2.2: BERT approach

2.2.3 Results

The framework reaches an accuracy of 93 percent and an F1-score of 95percent, surpassing conventional methods. However, the dependence on substantial computational resources and extensive datasets restricts its scalability.

2.3 Transforming Financial Planning with AI-Driven Analysis

2.3.1 Introduction

The paper by Addy et al. [3] examines the integration of Artificial Intelligence (AI) into financial planning, with a focus on how AI-driven tools can enhance decision-making processes, risk assessments, and fraud detection. The intricacy of financial planning has grown due to the rapid development of financial instruments and the vast amount of data available for analysis. This document aims to address these shortcomings by offering AI models that provide real-time data analysis and customized insights for financial planning. The study further emphasizes the ethical considerations and challenges associated with the deployment of AI within financial systems, including the imperative for transparency, fairness, and compliance with regulatory standards. The research highlights AI's

transformative potential, advocating for its adoption to create efficient, secure, and user-centric financial solutions.

2.3.2 Methodology

The approach taken in this study highlights the application of AI techniques for handling financial data and making informed decisions. The suggested framework comprises several essential components. Firstly, AI algorithms are used for processing and scrutinizing data, collecting, cleaning, and analyzing extensive datasets to guarantee that financial insights are based on precise and pertinent information. Predictive analytics is primarily concerned with discovering patterns and trends from past data, facilitating reliable projections of forthcoming occurrences that can contribute to informing investment and risk management strategies. Fraud detection in such scenarios is the most broad-based operation of modern-day cutting-edge AI algorithms, which deploy methods such as anomaly detection that keep enough detail in monitoring every transaction while efficiently detecting any suspicious activities in real time. Moreover, it personalizes user experience and shelter advice via AI- enabled systems that tailor themselves to the financial particulars regarding income and spending of various clients, as well as service-oriented approaches hinging on financial objectives. Numerous variables related to prediction accuracy and fraud detection have already been established as foundations for assessing the overall framework and its efficacy or trustworthiness in providing financial planning support. However, despite advancements in these areas, they continue to be pressing issues that necessitate intervention, including addressing privacy concerns regarding data and bias inherent in the AI models.

2.3.3 Results

The article, while recognizing these strengths like real-time adaptability and improved decision-making capabilities, draws attention to the significant challenges in AI systems: data privacy concerns and access limitations due to potential biases in AI models.

2.4 Summary and Gaps Identified

2.4.1 Summary

Table 2.1: Summary of Key Studies on Financial Strategy Systems

Study Title	**Advantages**	**Disadvantages**
SMP-DL: A Novel Stock Market Prediction Approach Based on Deep Learni	High prediction accuracy, Robust preprocessing	Overfitting, High computational demands
A BERT Framework for Sentiment Analysis of Tweets	High accuracy in sentiment prediction	Computational intensity, Limited scalability
Transforming Financial Planning with AI-Driven Analysis	Real-time adaptability, Ethical considerations	Data privacy concerns, Bias in AI models

2.4.2 Gaps Identified

The following gaps are identified:

1. Lack of seamless real-time adaptability for diverse user needs.
2. High computational demands limiting system scalability.
3. Limited integration of fraud detection mechanisms in predictive systems.
4. Insufficient focus on personalized advisory features for novice and advanced users.

MoneyMaster aims to address these gaps by integrating robust deep learning models, personalized advisory modes, and fraud detection mechanisms tailored for financial applications.

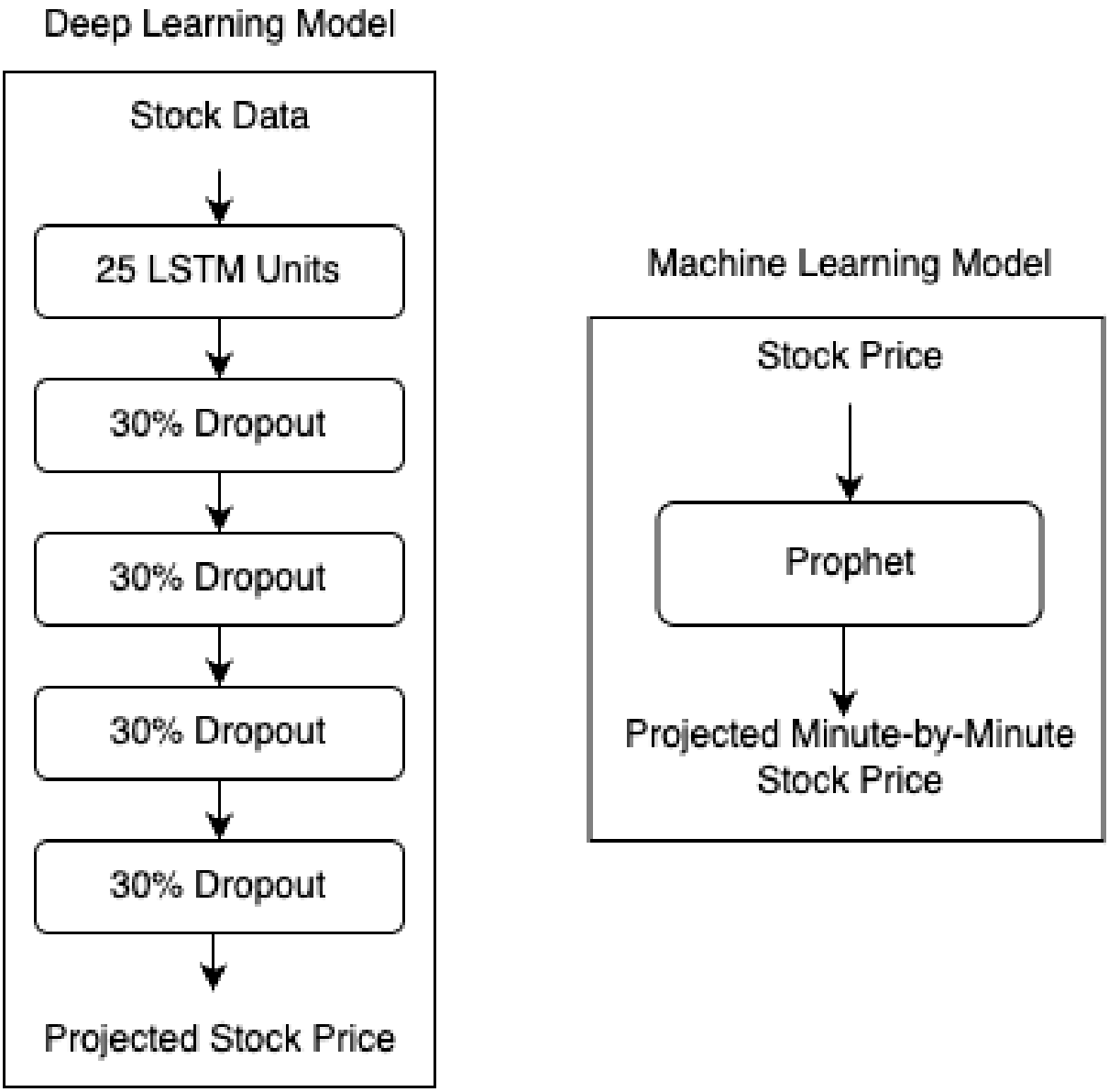
Chapter 3

System Design

This chapter provides diagrammatic representations of the system architecture, outlines details of each one of the components, discovers the algorithms applied at various stages, the technologies and tools utilized, and the data that has been identified for training the detection models. Finally, the chapter outlines the module breakdowns and work breakdown with the schedule to complete the project.

3.1 System Architecture

3.1.1 Stock Prediction Engine

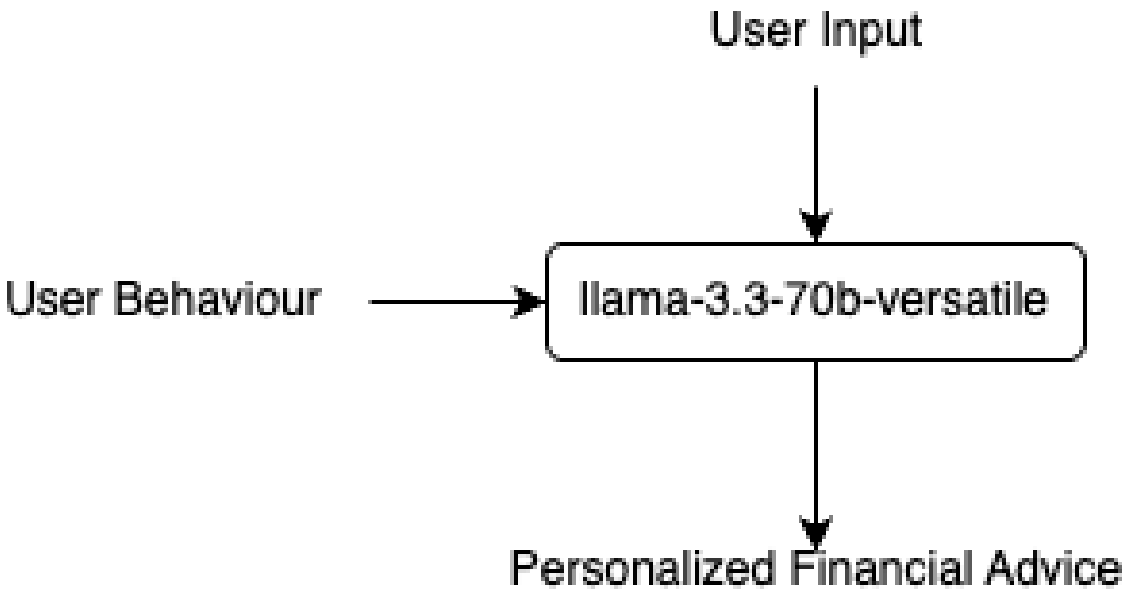


This module is responsible for forecasting prices from historical as well as contextual data. It consists of:

- **BiGRU:** Deals with sequential data by determining dependencies in forward and backward directions.
- **LSTM:**Identifies and remembers correct patterns in long sequences.
- **Dense Layer:** It consumes data from all the earlier layers to create a final prediction

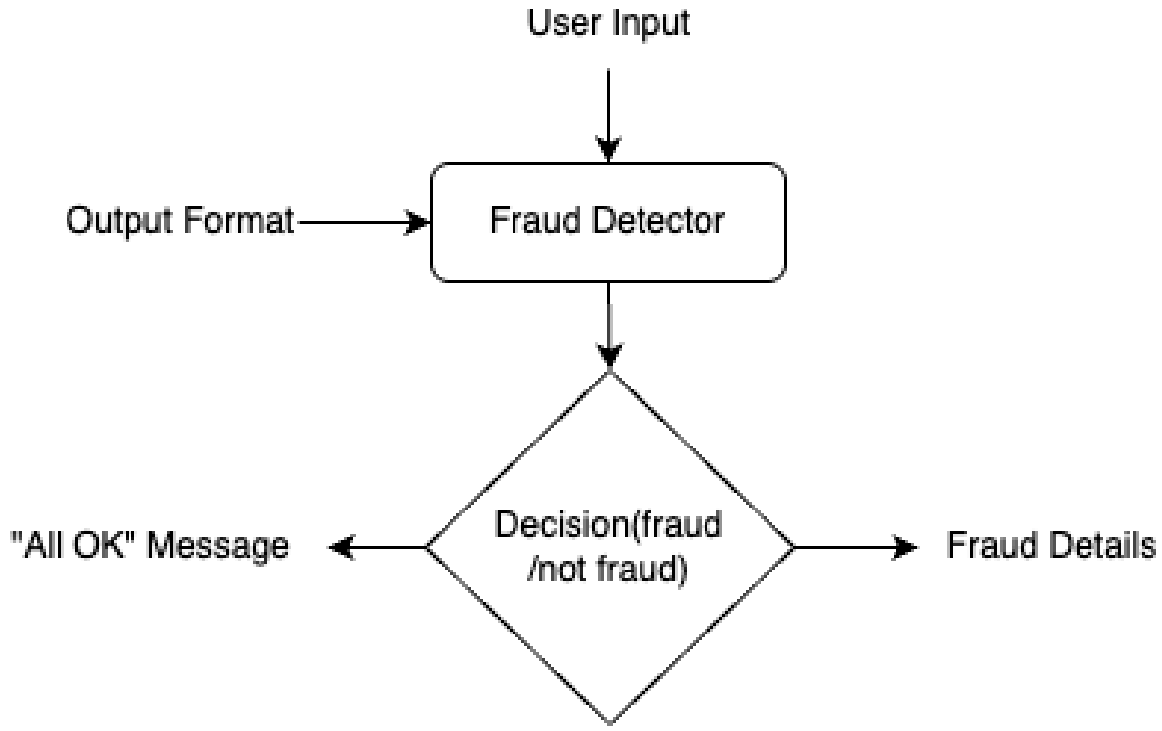
output

3.1.2 Personalized Financial Advice Generator



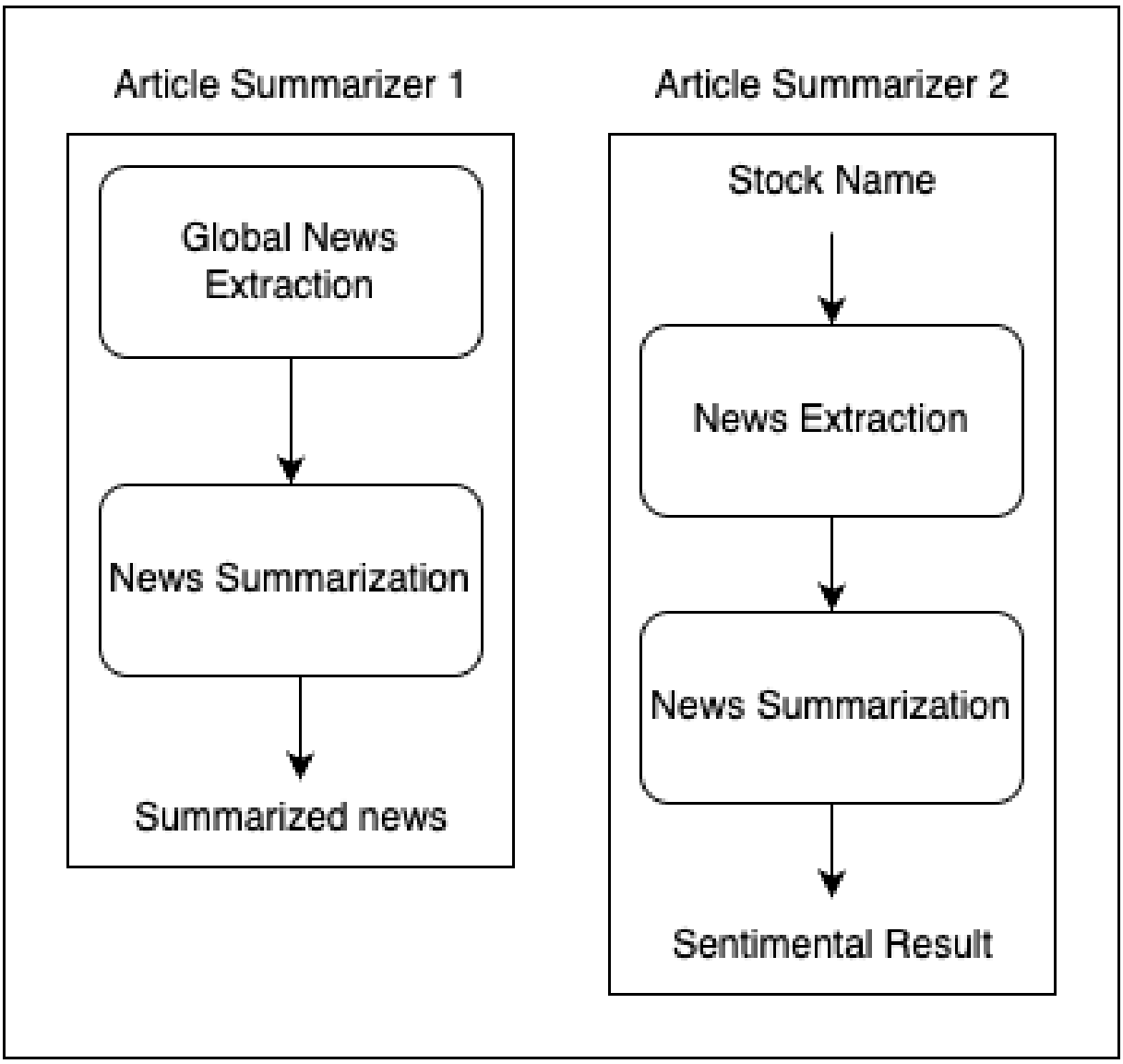
The user enters their income and expenses and this combined with user behavior is used to generate financial advice tailored to that user and his requirements.

3.1.3 Fraud Detector



This module protects the user's financial activities by identifying possible fraud. It analyzes potential anomalies in depth to confirm or reject cases of fraud.

3.1.4 Article Summarizers



Comprises of two article summarizers, created to serve two different purposes.

- **Global News Summarizer:** Present on the home page. Summarizes latest/trending global business news in an easy to understand manner.
- **Ticker-based Article Summarizer:** Generates summary of finance news and pertaining sentiment based on stock name provided to the input field.

3.1.5 User Interface

The User Interface serves as the main access point for users to interact with the system. It allows users to input their queries, access features, and view the output in a user-friendly manner.

3.2 Component Design

There are various components within the scope of this project

3.2.1 Textual Input from the User

The user enters information pertaining to their finances into the required fields. This can include data like expenses, financial strategy, queries and grievances, etc.

3.2.2 Input of Real Time Market Data

Live data is received using the yfinance library that can download historical and live stock market data. The module updates the application with the latest market trends and data at any time, enabling users to make informed decisions using timely information.

3.2.3 Processing of Textual Data

Text data is fed into Gemini API which receives data from the textual data and it translates. In case the content is passed for possible fraud, that context is provided to the API too, which then replies to the user appropriately.

3.2.4 Predicting Stock Prices and Plotting

The prediction engine has two models. A Prophet model provides minute-level predictions, providing short-term predictions (upto about 1.5 days) from real-time, high-frequency data. An LSTM-based model meanwhile—which has been trained on Nifty 50 day-to-day data for the period 2013-2025 with technical indicator guidance in the shape of 14-day RSI, 30-day SMA, and price deviation—Predicts tomorrow's closing price. Plotly.py is employed for creating plots, with short-term behavior clearly readable as well as next-day directions.

3.2.5 Machine Learning Models

- **Prophet Model:** Interacts with minute-level stock data (captured with yfinance) to capture high-frequency seasonality and trends. It is configured with the correct seasonality parameters (daily, weekly, or custom) to forecast for the next 1.5 days

- **LSTM-Based Model:** It is executed on TensorFlow/Keras and is trained against 2013-2025 Nifty 50 data. 14-day RSI, 30-day SMA, and price deviation are the technical indicators utilized in an attempt to increase the accuracy of the forecasts.Normalization is done using `MinMaxScaler`.
- **Data Integration:** Live data is pulled from yfinance and tickers are dynamically loaded from NSE via a custom API endpoint, prediction done based on the current market scenario.

3.3 Algorithms

3.3.1 Dual Model Stock Forecast

STEP 1: Start

Initiate the process of prediction by opening the modules needed and loading the dynamic NSE stock list.

STEP 2: Data Preprocessing

Import Required Modules

- Import libraries: `yfinance`, `pandas`, `Prophet`, and deep learning frameworks such as TensorFlow.
- Utilize plot libraries such as `matplotlib` and `Plotly.py`.

Load Data

- In minute-level predictions, retrieve recent stock information using `yfinance` (e.g., for 8 days with 1-minute gaps).
- For a day-ahead forecast, ensure historical data go as far back as necessary (Nifty 50from 2013 till 2025).

Normalize and Feature Engineering Normalize using MinMaxScaler for minute-level and daily collections of data and then compute technical indicators such as the 14-day RSI, 30-day SMA, and deviation, which are of utmost significance for the LSTM model.

STEP 3: Prophet Model Prediction (Minute-Level)

Prepare Data for Prophet Reshape minute-level data to the specifications needed by Prophet by renaming columns datetime and closing price as ds and y, respectively and filter the data to highlight recent trends using the latter part of the dataset

Model Configuration and Forecasting The Prophet model is initialized and trained with suitable seasonality parameters using preprocessed minute-level data.It then makes a forecast of 2160 minutes (1.5 days) ahead and the yhat pre-forecasting values are stored to analyze later.

STEP 4: LSTM-Based Model Prediction (Next Day)

Prepare Data for LSTM For training the LSTM model, the historical data are used on a day-to-day basis and the sliding window method is used in an attempt to create fixed-length sequences of 30-day windows. Technical indicators such as RSI, SMA, and deviation are added to the feature set in an attempt to enhance predictive accuracy further.

Model Initialization and Prediction Load the pre-trained LSTM model (from `nifty50_model_wi` and then Apply function `get_latest_window_features()` in order to initialize the latest window features. Forecast the closing price of the next day and approximate the difference percentage from the current closing price.

STEP 5: Visualization and API Integration

Generate Charts and Display Results

Plot minute-resolution Prophet forecasts from the historical data and Display the LSTM model's prediction of the next day along with technical details such as the predicted close and

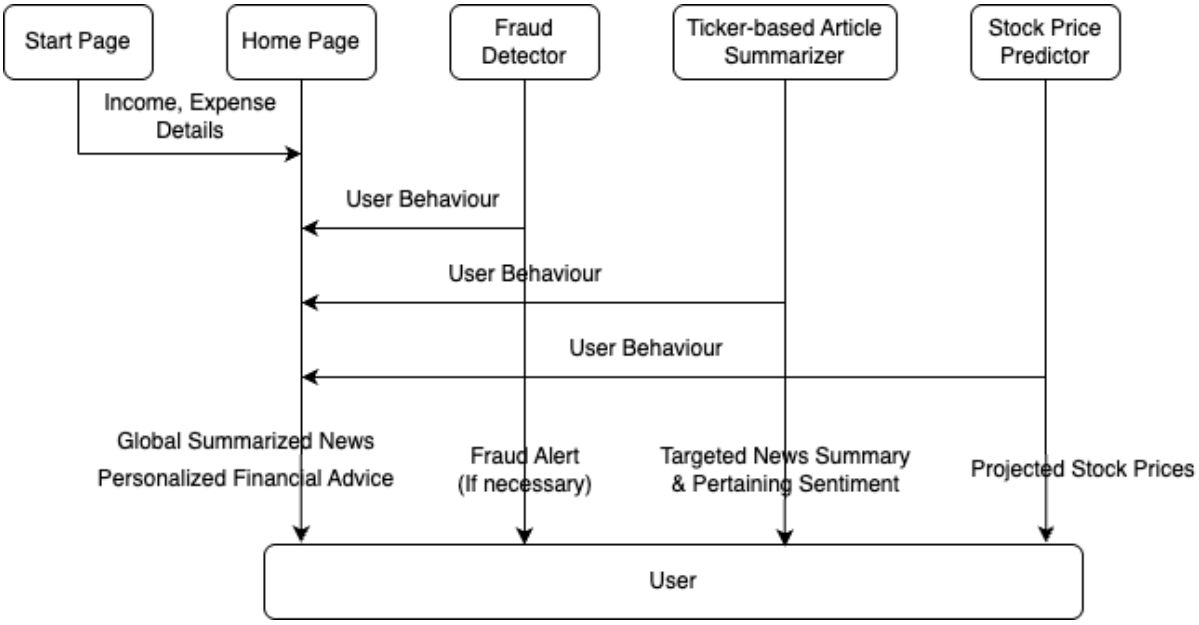
API Endpoints and Output

Allow endpoints to retrieve NSE tickers as well as generate charts (`/get-tickers` and `/generate-chart`) and enable error handling and dynamic ticker validation

from the set of NSE stocks.3.5 Tools and Technologies

STEP 6: Stop

3.4 Data Flow Diagram



3.5 Tools and Technologies

3.5.1 Hardware Requirements

CPU: Intel i3/Ryzen 3 or higher

Such CPUs offer sufficient computational power for the nature of development tasks such as running IDEs, Python code, and miniature AI models. They are able to deal with real-time financial news flashes, fraud detection, and stock predictions at the developmental stage in an efficient manner.

RAM: 8 GB

It therefore supports glitch-free multitasking as well as running of machine learning models such as BERT, and development and testing environments. It has sufficient capacity for processing Financial data and real-time currently..

Storage: 50 GB SSD

An SSD guarantees quick read/write times, quick app launch, and effective proj-ect file handling, such as datasets, AI models, and user data. This configuration reconciles development requirements with the system not becoming unresponsive.

3.5.2 Software Requirements

Software Requirements (Server-Side)

Frontend Framework: ReactJS Backend Framework: Flask Database: PostgreSQL APIs: yfinance, Gemini, NewsAPI, llama

Client-Side Requirements (User)

Browser: Any regular web browser (Chrome, Firefox, Safari). Internet Speed: 10 Mbps or more for smooth interaction with real-time financial data.

3.6 Datasets Identified

Two sources of data make it possible to apply the stock prediction models. For 1-minute-ahead predictions with the Prophet model, data is drawn real-time from `yfinance`. The data covers the latest trading history (e.g., 8 days with 1-minute resolution) and has significant features such as Open, High, Low, and Close. For daily-ahead predictions with the LSTM-based model, a historical dataset of the Nifty 50 index is used, from 2013 to 2025. This dataset has been enriched with technical indicators like the 14-day RSI, 30-day SMA, and price deviation, and preprocessed to contain missing values. Both datasets are the foundation of constructing strong stock price predictive models.

3.7 Module Divisions and Work Breakdown

3.7.1 Module Divisions

User Interface

The User Interface makes it easy for users to interact with the application. It enables them to enter financial information, see forecasts, and access guidance in an organized,

easy-to-read manner. Suitable for both novices and experts, it offers real-time updates and easy navigation. The UI simplifies complex financial data and provides detailed choices for experienced users. This makes it possible for anyone to plan and make decisions with confidence.

Price Prediction Engine

The Price Prediction Engine operates as a model of data analysis specifically intended to scrutinize the data of the particular stock for the past periods and start forecasting the value in the subsequent period. It employs these models for pattern detection and the creation of effective forecasts. These forecasts facilitate users' understanding of how to make more efficient investment decisions. This knowledge partner module has particularly aimed at significant financial ratios. In order to ensure that the users are furnished with correct information to allow proper strategies to be implemented.

Fraud Detection

Fraud Detection module provides safety to the users up to a level by preventing such activities as, for example insider trading or other unlawful transactions. It can indeed scan financial data for some indications of fraud using code and sophisticated logarithms that exist in each human brain based on previous planned and organized protocols. If something risky is detected, it gives an alert to the user.

Personalized Financial Advice Generator

This module give user's financial advice based on inputs such as income and expenses which are taken and processed by the system. It suits beginners, and it also suits what we call sophisticated investors, which simply means people who have been investing for a while. As an initial starting point for new investment forms of analysis and more detailed analysis for specialists.

Article Summarizer

The Article Summarizer takes information about financial news and delivers it in an overview form. It divides news into positive and negative and so enables the users catch

the trend of the markets easily. This helps one avoid repeating the search process and in the process ease the identification of relations between opportunities or risks attributable to investments. It also creates summaries of latest global business news.

3.7.2 Work Breakdown

TASK	TEAM MEMBER(S)
UI	Thomas Thayyil Ryan Thomas
Personalized Financial Advice Generator	Nithin John
Stock Prediction Engine	Ryan Thomas
Global Article Summarizer	Thomas Thayyil
Ticker-based Article Summarizer	Ryan Thomas Nithin John
Fraud Detector	Thomas Thayyil

3.7.3 Key Deliverables

AI-Driven Stock Prediction Module

A fully working engine for analyzing historical stock data and making forecasts about the future to enable clients make better investment decisions They help the users to make right investment decisions.

Fraud Detection System

An enhanced technique to notify the related users about the related and potentially dangerous financial operations.

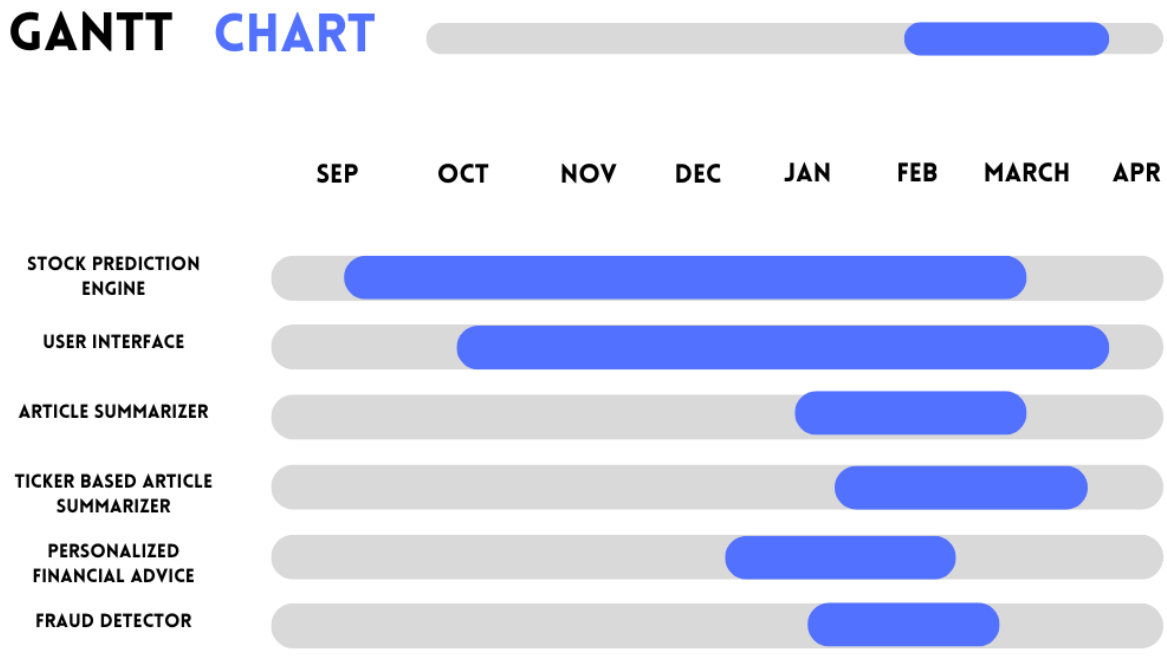
Personalized Financial Advice Generator

Creates financial advice tailored to a person's needs and current economic conditions.

Article Summarization Tools

A tool that translates press releases into simpler language, and filters information into neat categories. Rating as positive or negative is used to help make a fast decision.

3.7.4 Project Timeline



Chapter 4

System Implementation

This chapter formally documents the methodology used in this project and its implementation. It describes the data collection, preprocessing, model training, evaluation (such as directional accuracy evaluation), and integration into a web-based application steps. The solution is centered around predicting stock prices with an LSTM model augmented with the inclusion of technical indicators and supplemented with a Prophet model for minute-scale prediction.

4.1 Datasets Identified

- **Historical Stock Data:** The main dataset is fetched using yfinance for the Nifty 50 index. Raw data set has columns like Date, Open, High, Low, Close, and Volume for the whole time period for which data are available.
- **Technical Indicator Data:** Apart from raw data, certain technical indicators are calculated:
  - **RSI (14-day):** Closing price Relative Strength Index.
  - **SMA (30-day):** A basic closing price moving average that is easy to utilize.
  - **Deviation:** The distance between the close price and SMA, utilized as a secondary indicator.

4.2 Proposed Methodology

4.2.1 Data Acquisition and Preprocessing

The first task is to fetch the historical data of the Nifty 50 share from yfinance. The data fetched is preprocessed by making the key columns numeric and removing error volume

records. Technical indicators are then computed to improve the dataset. For instance, the RSI of 14-day is computed using closing prices, and 30-day SMA is used to compute the deviation indicator.

Figure 4.1: Screenshot of the code for downloading and preprocessing Nifty 50 data.

4.2.2 Preparation of Dataset for Time-Series Forecasting

The preprocessed data is transformed into a sliding-window dataset to be utilized for time-series forecast-ing. A 30-day window size is utilized to create input sequences, and the target is the closing price of the next day. The entire feature set of eight variables (the orig- initial five characteristics and the three technical indicators. The features are normalized using the MinMaxScaler so that all features have equal scaling.

4.2.3 Model Building and Training

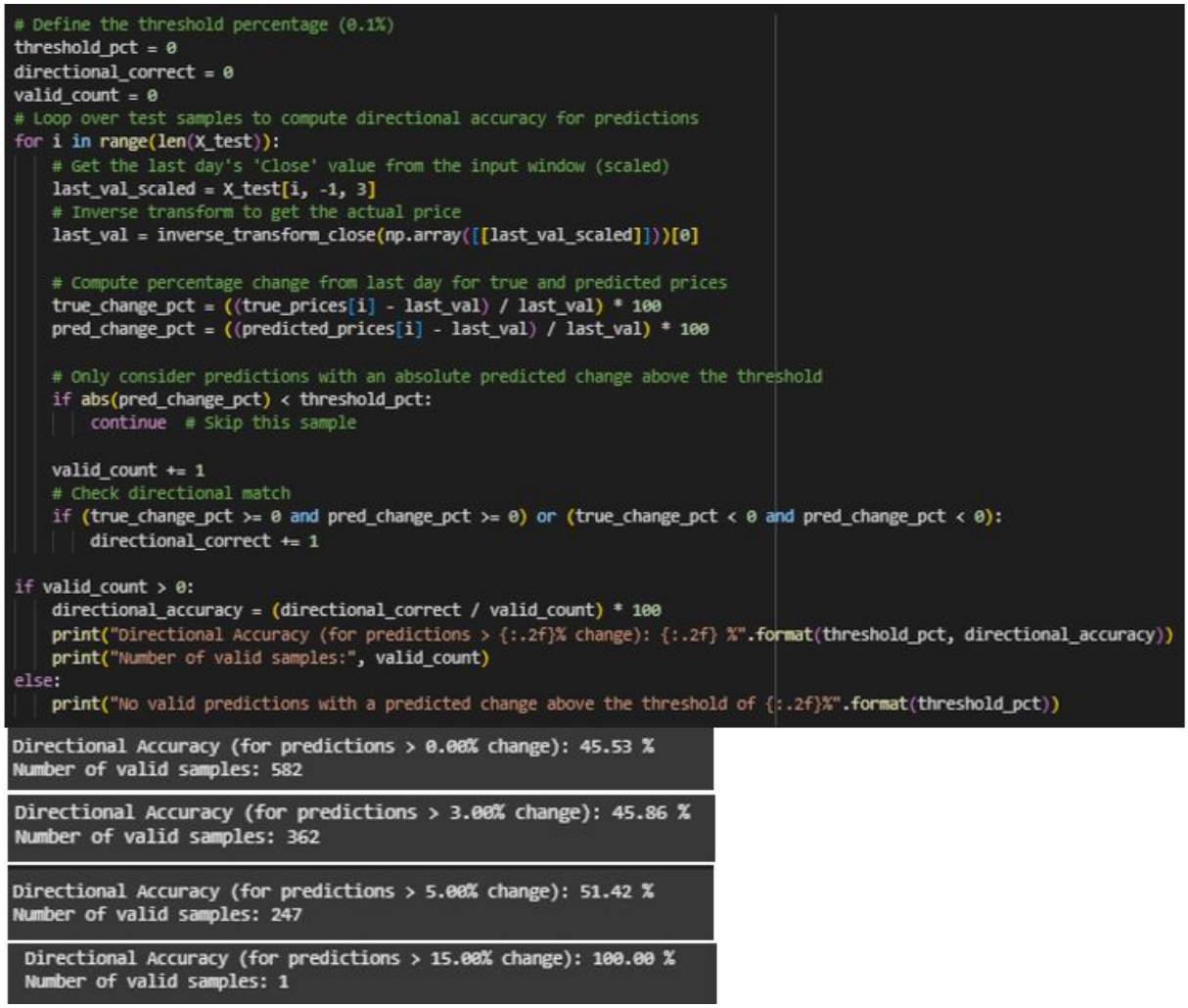
The model employed is an LSTM-based network implemented using TensorFlow/Keras. The model has two LSTM layers with dropout regularization and a dense layer that outputs the predicted closing price. The model is trained using an early validation loss stopping condition to prevent overfitting. Figure 4.3 is a model architecture and training process screenshot

```
features = ['Open', 'High', 'Low', 'Close', 'Volume', 'RSI14', 'SMA30', 'Deviation']
data = df[features].values

# Scale all features to [0,1]
scaler = MinMaxScaler(feature_range=(0, 1))
scaled_data = scaler.fit_transform(data)

# Create sliding-window dataset function (target: next day's 'Close', index 3 in our feature list)
def create_dataset_multivariate(dataset, window_size=30):
    X, y = [], []
    for i in range(window_size, len(dataset)):
        X.append(dataset[i-window_size:i, :])
        y.append(dataset[i, 3])  # 'Close' is at index 3 in our feature vector
    return np.array(X), np.array(y)

window_size = 30
X, y = create_dataset_multivariate(scaled_data, window_size)
print("X shape:", X.shape, "y shape:", y.shape)

# Split data into training and testing sets (80% training)
split = int(0.8 * len(X))
X_train, X_test = X[:split], X[split:]
y_train, y_test = y[:split], y[split:]

model = Sequential()
model.add(LSTM(25, return_sequences=True, input_shape=(window_size, 8)))  # Now 8 features per time step
model.add(Dropout(0.3))
model.add(LSTM(25))
model.add(Dropout(0.3))
model.add(Dense(1))

model.compile(optimizer='adam', loss='mean_squared_error')
model.summary()
early_stop = EarlyStopping(monitor='val_loss', patience=10, restore_best_weights=True)
history = model.fit(X_train, y_train, epochs=100, batch_size=16, validation_split=0.1, callbacks=[early_stop])

def inverse_transform_close(scaled_values):
    n = scaled_values.shape[0]
    dummy = np.zeros((n, 8))
    dummy[:, 3] = scaled_values[:, 0]
    inv = scaler.inverse_transform(dummy)
    return inv[:, 3]
```

Figure 4.3: Screenshot of the LSTM model architecture and training code.

4.2.4 Model Evaluation and Directional Accuracy Test

Apart from the common metrics such as RMSE and MAPE, direction accuracy test is done. Direction accuracy test verifies the extent to which the model can accurately predict the direction of price movement. Although a 50conditions. For instance, if a threshold is 5is more than 45that the LSTM model captures hidden market trends, which is significantly crucial for the future pattern recognition and predictive analytics studies. The studies and results of this evaluation are indicated in Figure 4.4.



```
# Define the threshold percentage (0.1%)
threshold_pct = 0
directional_correct = 0
valid_count = 0
# Loop over test samples to compute directional accuracy for predictions
for i in range(len(X_test)):
    # Get the last day's 'Close' value from the input window (scaled)
    last_val_scaled = X_test[i, -1, 3]
    # Inverse transform to get the actual price
    last_val = inverse_transform_close(np.array([[last_val_scaled]]))[0]

    # Compute percentage change from last day for true and predicted prices
    true_change_pct = ((true_prices[i] - last_val) / last_val) * 100
    pred_change_pct = ((predicted_prices[i] - last_val) / last_val) * 100

    # Only consider predictions with an absolute predicted change above the threshold
    if abs(pred_change_pct) < threshold_pct:
        continue  # Skip this sample

    valid_count += 1
    # Check directional match
    if (true_change_pct >= 0 and pred_change_pct >= 0) or (true_change_pct < 0 and pred_change_pct < 0):
        directional_correct += 1

if valid_count > 0:
    directional_accuracy = (directional_correct / valid_count) * 100
    print("Directional Accuracy (for predictions > {:.2f}% change): {:.2f} %".format(threshold_pct, directional_accuracy))
    print("Number of valid samples:", valid_count)
else:
    print("No valid predictions with a predicted change above the threshold of {:.2f}%".format(threshold_pct))
```

```
Directional Accuracy (for predictions > 0.00% change): 45.53 %
Number of valid samples: 582
```

```
Directional Accuracy (for predictions > 3.00% change): 45.86 %
Number of valid samples: 362
```

```
Directional Accuracy (for predictions > 5.00% change): 51.42 %
Number of valid samples: 247
```

```
Directional Accuracy (for predictions > 15.00% change): 100.00 %
Number of valid samples: 1
```

Figure 4.4: Screenshot showing the directional accuracy test results under various thresholds.

4.2.5 Integration into the Web Application

The trained LSTM model is integrated with a web app and a Prophet model for 1-minute level prediction.The web application has API endpoints to fetch NSE tickers and fetch combined prediction graphs. The LSTM model makes the prediction for the next day based on daily-level data, whereas the Prophet model makes short-term prediction until the next 1.5 days based on 1-minute-level data. Having two models gives the system's predictability more power as it can learn both long-term patterns and short-term oscillations.

4.3 Summary of Implementation Strategies

The implementation of the system includes making use of in-depth historical stock data and calculated technical indicators in conjunction with quality data and normalized data through an effective preprocessing pipeline. An LSTM model is formulated with proper regularization and early stopping to improve the performance, whereas a strict process of evaluation in the form of directional accuracy tests ensures its efficiency in capturing the market trends. Moreover, integrated use of LSTM and Prophet models in a web application facilitates real-time prediction. The findings are in agreement with the effectiveness of the LSTM model in detecting the patterns of stock markets and create a solid foundation for further developments and enhancements.

Chapter 5

System Implementation

This chapter provides a clear description of the methods used in this project and their implementation. The data processing pipeline, model selection and sys- tem design framework for stock prediction based on a hybrid mechanism with Facebook Prophet and an LSTM model.

5.1 Datasets Identified

Information used here in this project are historical prices of some of the Nifty 50 stocks, which are downloaded with `yfinance`. The most important columns of the dataset are:

- **Date:** The trading date.
- **Open Price:** The price at market open.
- **High Price:** The highest price during the trading session.
- **Low Price:** The lowest price during the trading session.
- **Close Price:** The price at market close.
- **Volume:** The number of shares traded.

Other than the raw numbers, the technical indicators such as the 14-day RSI, 30-day Simple Moving Average (SMA), and deviation (Close - SMA) is calculated as an effort to improve feature set on which model is trained.

5.2 Proposed Methodology

5.2.1 Data Acquisition and Preprocessing

Data Pre-processing and Collection Raw data is initially collected and preprocessed afterwards to handle missing values (as to non-trading days and rebase the data. The following are achieved:

- yfinance data is fetched and cleaned.
- Numeric conversion is assured for columns such as Open, High, Low, Close, and Vol- ume.
- Technical measures (RSI, SMA, Deviation) are computed.
- The data is normalized and split into training and test sets.

5.2.2 Predictive Modeling Approach

A hybrid forecasting approach is implemented, consisting of two models:

Facebook Prophet

A hybrid forecasting method is used with two models: Facebook Prophet Prophet is utilized for minute-level predictions. It is appropriate for trend and seasonality components, with smooth trend-based predictions to short-run (up to approximately 1.5 days.).

LSTM (Long Short-Term Memory)

A TensorFlow/Keras model is developed to forecast stock prices on subsequent days based on on a day data set. The model is improved by including technical indicators in its feature space and is constructed to reflect short-run variability

5.3 System Implementation Strategies

5.3.1 Used Libraries

The deployment is based on a number of Python libraries, such as **pandas** and **numpy** for data handling and numerical operations, **matplotlib** and **seaborn** for data visualization,

scikit-learn for data normalization and testing, **Facebook Prophet** for forecasting of time series, and **TensorFlow/Keras** for model development and training of the LSTM model.

5.3.2 Application Workflow

The software used to forecast stocks is easy to use. The steps involved are as follows:

1. Historical data are retrieved and preprocessed.
2. It is used to generate a sliding-window dataset for the LSTM model.
3. Both LSTM and Prophet models provide forecasts.
4. The results are presented as consolidated forecasts in one screen. 5.3.3. Training and Validation Training of the LSTM model is performed with batch size 32, 50 epochs, Adam optimizer, Mean Squared Error (MSE) loss, and 80-20 split for training and testing, and Prophet is optimized with parameters like seasonality mode and changepoint priors to improve the model to track trends in the market.

5.4 Implementation Results

Screenshots of the application show the combined outputs of the Prophet and LSTM models for four Nifty 50 stocks. All screenshots show the minute-level forecast by Prophet and the next-day forecast by the LSTM model. The results show a smooth trend forecast generated by Prophet and the short-term fluctuations identified by the LSTM model, illustrating the effectiveness of the hybrid model for stock market forecasting.

Figure 5.1: Stock Prediction for Reliance Industries: Combined Prophet and LSTM outputs.

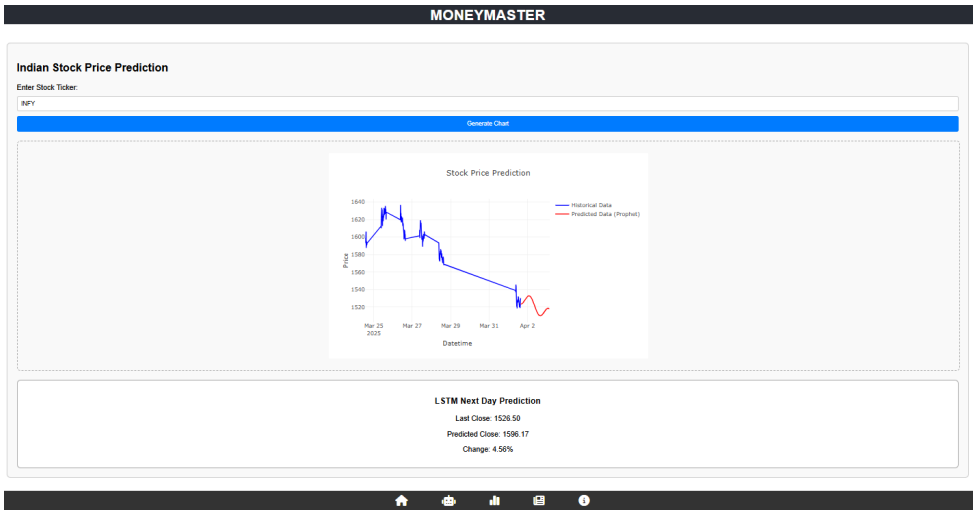


Figure 5.2: Stock Prediction for Infosys: Combined Prophet and LSTM outputs.

Figure 5.3: Stock Prediction for TCS: Combined Prophet and LSTM outputs.

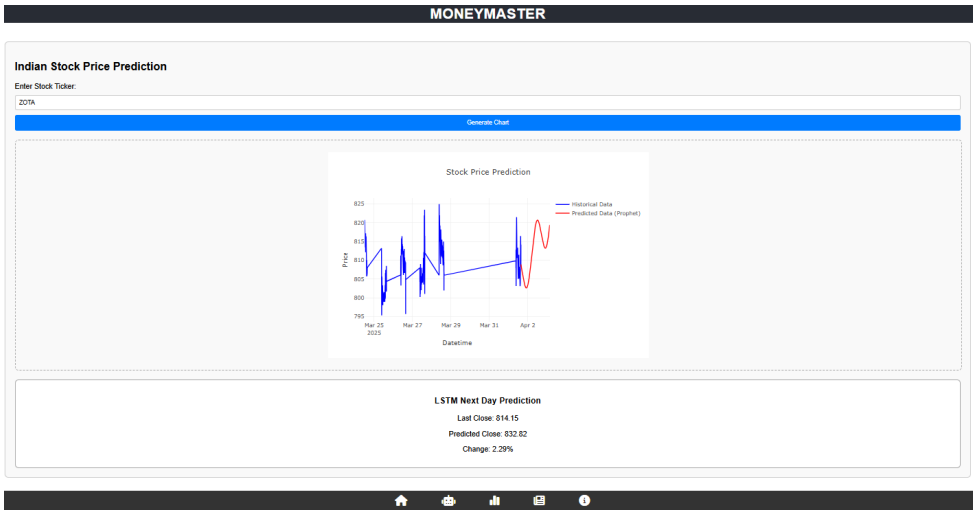


Figure 5.4: Stock Prediction for ZOTA: Combined Prophet and LSTM outputs.

5.5 Chapter Conclusion

The deployment of the stock forecasting system is marked by a strong data preprocessing pipeline and a two-model forecasting strategy. The combination of Prophet and LSTM models enables the capture of long-term trends and short-term oscillations. The outcome, as shown by the application screenshots, proves that the hybrid system offers an overall picture of stock price movements, thereby providing a solid foundation for model enhancements and further research.

Chapter 6

Conclusion and Future Scope

Briefly, the project has developed an all-round stock forecasting framework using the latest AI technologies to assist in making financial choices. The software makes use of yfinance's historical stock data and added calculated technical indicators like RSI, SMA, and Deviation, then applies a sliding-window approach to time-series prediction. The proposed LSTM model, designed with two layers of LSTM and dropout regularization, gives accurate predictions of tomorrow's closing price, and its accuracy is also measured not only with the usual metrics such as RMSE and MAPE but also with a directional accuracy test. The addition of a Prophet model also allows minute-level prediction, complementing the daily predictions of the LSTM and giving a solid basis for the derivation of long-term trends as well as short-term market movements. The integration of these models seamlessly into a web-based application—with API endpoints for fetching NSE tick- ers and combined prediction charts—illustrates that the prediction system is not only theoretically sound but also implementable in practice. In addition, the project has developed an application that benefits from the current AI technologies in making financial choices by offering personalized investment suggestions, precise stock market predictions, and fraud protection as well as article summaries. All these features are new, being beneficial to professionals and novices alike by offering personalized insights as well as developing user confidence by having strong security features. In the coming times, there are some possibilities of ongoing development on the platform. Future efforts may be spent in making forecasting more accurate with a more versatile array of datasets and polishing the algorithms underpinning it. Polishing the fraud detection engine to include novel financial threats will further strengthen protection for users. Furthermore, adding free multilingual access could enhance the reach

of the platform and make it an even more inclusive solution. All these upgrades improvements would keep the platform up to date and able to meet the real-time needs of the financial community.

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[1] W. M. Shaban, E. Ashraf, and A. E. Slama, "Smp-dl: A novel stock market prediction approach based on deep learning for effective trend forecasting," *Neural Computing and Applications*, vol. 36, pp. 1849–1873, 2024.

[2] A. Bello, S.-C. Ng, and M.-F. Leung, "A bert framework to sentiment analysis of tweets," *Sensors*, vol. 23, no. 1, p. 506, 2023.

[3] W. A. Addy, A. Ajayi-Nifise, B. G. Bello, S. T. Tula, O. Odeyemi, and T. Falaiye, "Transforming financial planning with ai-driven analysis: A review and application insights," *World Journal of Advanced Engineering Technology and Sciences*, vol. 11, no. 1, pp. 240–257, 2024.

Appendix A: Presentation

Financial Strategy Application

Team Members:

Ryan Thomas
Thomas T. Thayyil
Nithin John

Guide:

Mr. Biju Abraham Narayamparambil

Contents

Problem Definition

- Investors face challenges in making informed financial decisions due to:
  - complex market dynamics
  - large volumes of data
  - risk of fraud

Purpose and Need

Purpose:
MoneyMaster aims to empower users with personalized financial advice, real-time market updates, and advanced stock predictions, providing a reliable, AI-driven platform to optimize investments.

Need:

- **For Beginners:** Clear, step-by-step guidance to navigate complex investment decisions with confidence.
- **For Experts:** Advanced analysis and predictive insights to stay ahead of market trends and make data-driven choices.
- **For All Users:** Real-time updates, fraud alerts, and news summaries to enhance decision-making and protect investments from potential risks.

Project Objective

To provide users with a comprehensive, AI-driven financial platform that:

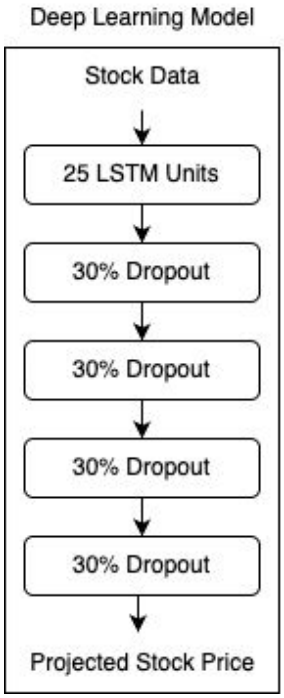
- delivers personalized investment advice
- real-time market updates
- predictive stock analysis
- robust fraud detection

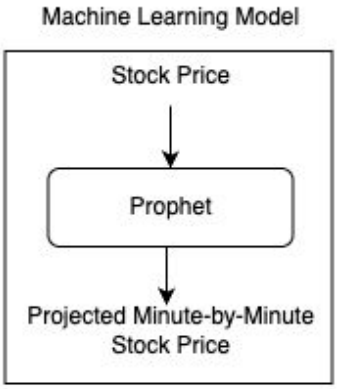
Proposed Method

- Personalized Financial Advice Generator
- Stock Prediction Engine
- Fraud Detection System
- Article Summarizers
- User Interface

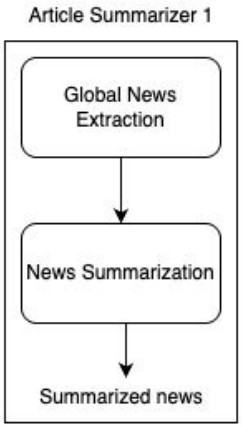
ARCHITECTURE DIAGRAM

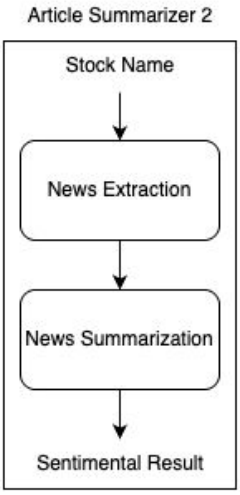
Stock Prediction Engine



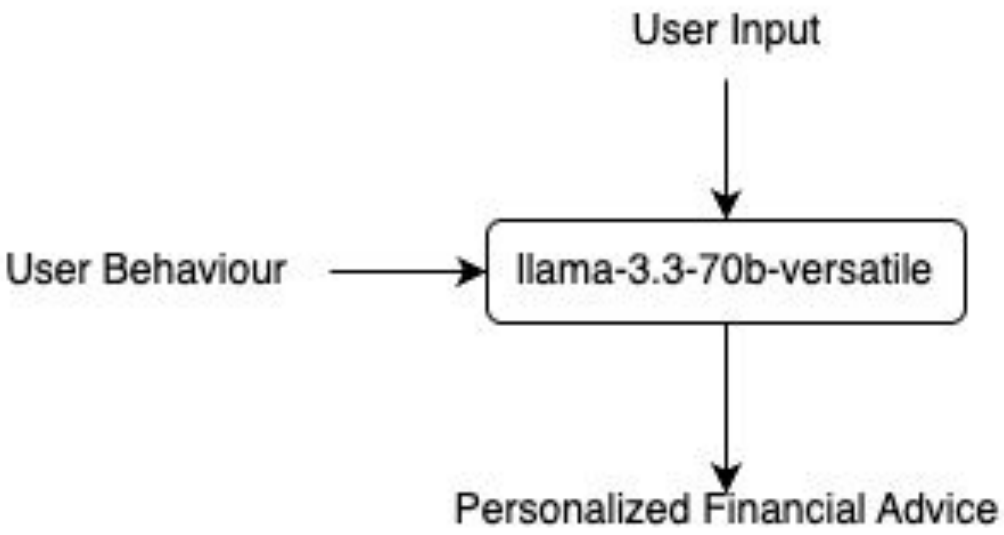


Article Summarizers

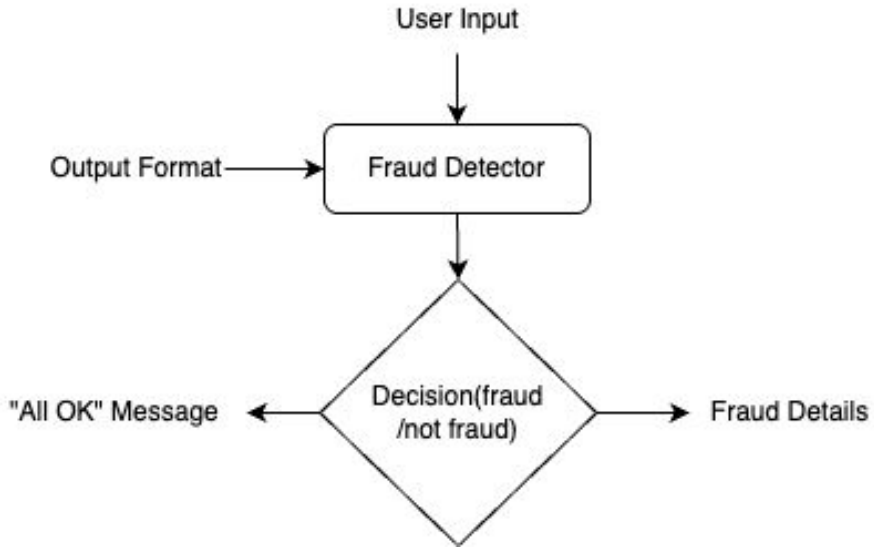




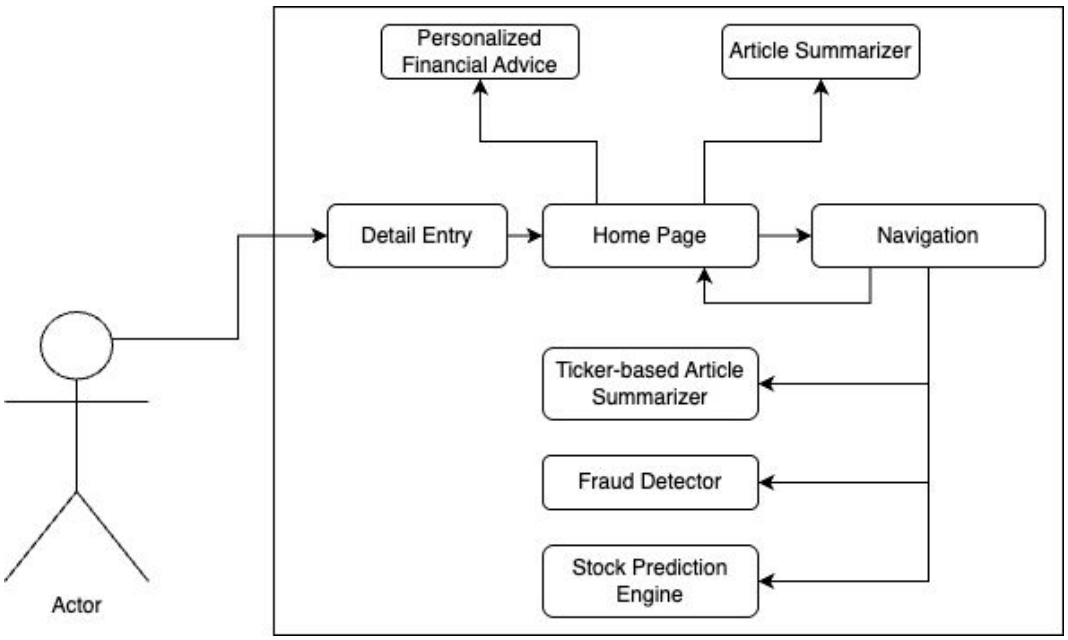
Personalized Advice Module



Fraud Detection Module



Use Case Diagram



MODULES

USER INTERFACE LAYER

Purpose: Allow users to interact with he various modules

Tools & Libraries:

- **Frontend:** React
- **Charts:** plotly

PERSONALIZED FINANCIAL ADVICE MODULE

Purpose: Based on user inputs and behaviour, tailored financial advice is generated

Tools:-

- **Flask**: Creates a lightweight web server for handling user requests
- **llama-3.3-70b-versatile**: Provides generative AI capabilities for responding to financial inquiries using Meta's language model

ARTICLE SUMMARIZER

Purpose: Aggregate and summarize latest global financial news to be displayed on the home page

Tools & Libraries:

- **Article retrieval:** NewsAPI
- **Text Summarization:** llama-3.3-70b-versatile

TICKER BASED ARTICLE SUMMARIZER

Purpose: Give summaries based on ticker(Stock Name) entered by the user

Tools & Libraries:

- **Article retrieval:** yFinance
- **Text Summarization:** llama-3.3-70b-versatile

STOCK PREDICTION ENGINE

Purpose: Analyze historical data and current trends using machine learning to forecast stock movements

Tools & Libraries:

- **Prophet:** ML model for trends
- **MinMaxScaler (Scikit-learn):** To normalize data between 0 and 1, ensuring better performance during model training.
- **Keras Sequential Model:** A simple stack of layers for building neural networks.
- **TensorFlow:** For deep learning computations and training models.
- **LSTM, Dropout, Dense:** Layers used for building the LSTM model.
- **Data Sources**: yfinance, kaggle.

FRAUD DETECTION SYSTEM

Purpose: Monitor inputs to identify potential suspicious/fraudulent activity

Tools & Libraries:

- **Fraud identification:** Gemini 1.5 module
- **Text Summarization:** Gemini 1.5 module

ASSUMPTIONS

- **User Engagement:** Users will actively input financial data and seek advice regularly.
- **Market Availability:** Real-time financial data is accessible through reliable APIs.
- **Fraud Detection Reliability:** The system will accurately identify and alert users to potential fraud.
- **Privacy and Security:** Users trust the app to securely store their financial information.
- **Adaptability:** The application will evolve with changing market conditions and user needs.

WORK BREAKDOWN & RESPONSIBILITIES

01 **THOMAS THAYYIL**
User Interface(frontend)
Fraud Detection
Article Summarizer(global)

02 **RYAN THOMAS**
User Interface(frontend)
Article Summarizer(ticker based)
Stock Prediction Engine

03 **NITHIN JOHN**
Personalized Financial Advice Module

REQUIREMENTS

HARDWARE

- **CPU**: Intel i3/Ryzen 3 or higher
- **RAM**: 4 GB
- **Storage**: 50 GB SSD

SOFTWARE

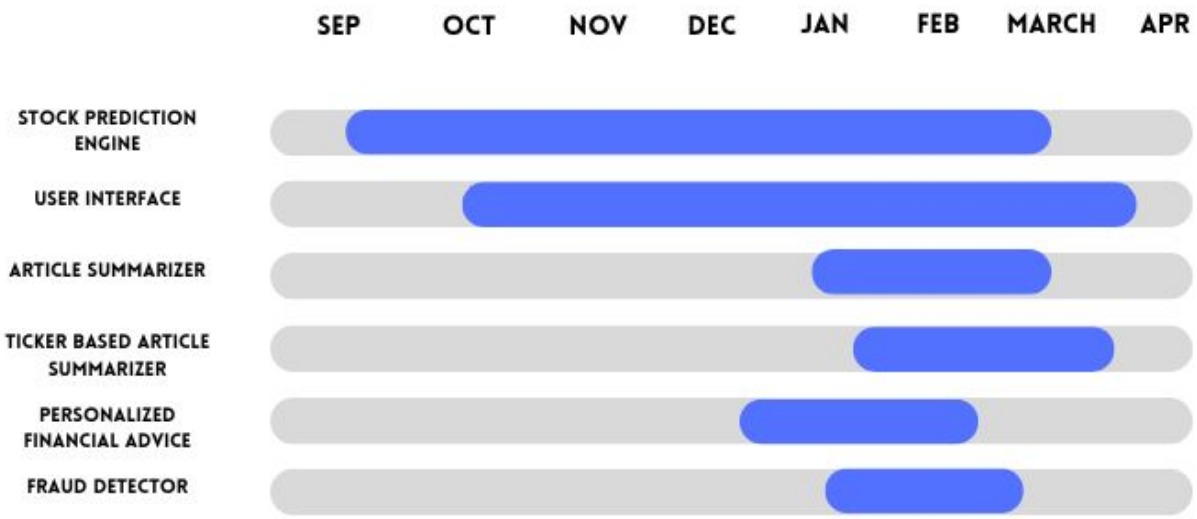
Software Requirements (Server-Side):

- **Frontend Framework:** ReactJS
- **Backend Framework**: Flask
- **APIs**: groq, llama-3.3-70b-versatile, yfinance, Gemini, NewsAPI, etc.

Client-Side Requirements (User):

- **Browser**: Any modern browser (Chrome, Firefox, Safari).
- **Internet Speed**: 10 Mbps or higher for smooth interaction with financial data.

GANTT CHART



RISKS AND CHALLENGES

- **Data Accuracy:**
  Inaccurate or incomplete user inputs may lead to incorrect financial advice, affecting user trust.
- **API Dependency:**
  Reliance on third-party financial data APIs could cause disruptions if the APIs are unreliable or change unexpectedly.
- **Machine Learning Accuracy:**
  Stock prediction models may not always produce accurate results, potentially leading to financial losses for users.
- **Fraud Detection Limitations:**
  The fraud detection system might generate false positives or miss actual fraud, impacting its effectiveness.
- **Scalability:**
  As the user base grows, maintaining performance and ensuring smooth operation could become a challenge.
- **Data Privacy:**
  Ensuring the security of sensitive financial data is critical to prevent breaches and protect user information.

100% OUTPUT

Objectives

- User Interface to date
- Prophet Model Creation
- SMP-DL Model Training
- Output of SMP-DL
- Fraud Detection
- Article summarizer

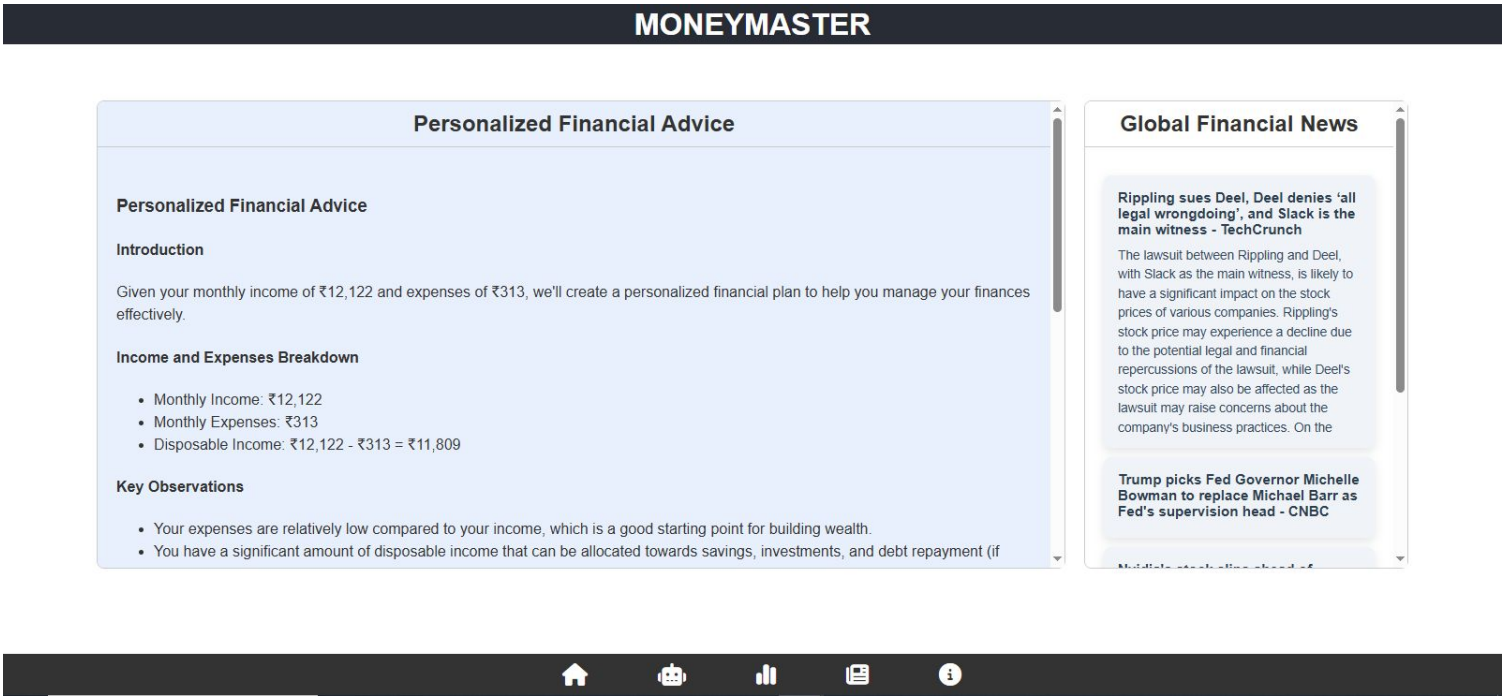
Dataset Nifty 50 Index Daily data (2013 to 2025)

Date	Open	High	Low	Close	Volume	Dividends	Stock Splits
2013-01-21 00:00:00+05:30	6085.750000	6094.350098	6065.100098	6082.299805	130900	0.0	0.0
2013-01-22 00:00:00+05:30	6080.149902	6101.299805	6040.500000	6048.500000	129000	0.0	0.0
2013-01-23 00:00:00+05:30	6052.850098	6069.799805	6021.149902	6054.299805	137000	0.0	0.0
2013-01-24 00:00:00+05:30	6046.200195	6065.299805	6007.850098	6019.350098	185200	0.0	0.0
2013-01-25 00:00:00+05:30	6024.500000	6080.549805	6014.450195	6074.649902	147600	0.0	0.0
...	...	...	...	...	...	...	...
2025-03-24 00:00:00+05:30	23515.400391	23708.750000	23433.500000	23658.349609	311900	0.0	0.0
2025-03-25 00:00:00+05:30	23751.500000	23869.599609	23601.400391	23668.650391	338200	0.0	0.0
2025-03-26 00:00:00+05:30	23700.949219	23736.500000	23451.699219	23486.849609	278600	0.0	0.0
2025-03-27 00:00:00+05:30	23433.949219	23646.449219	23412.199219	23591.949219	510300	0.0	0.0
2025-03-28 00:00:00+05:30	23600.400391	23649.199219	23450.199219	23519.349609	295400	0.0	0.0

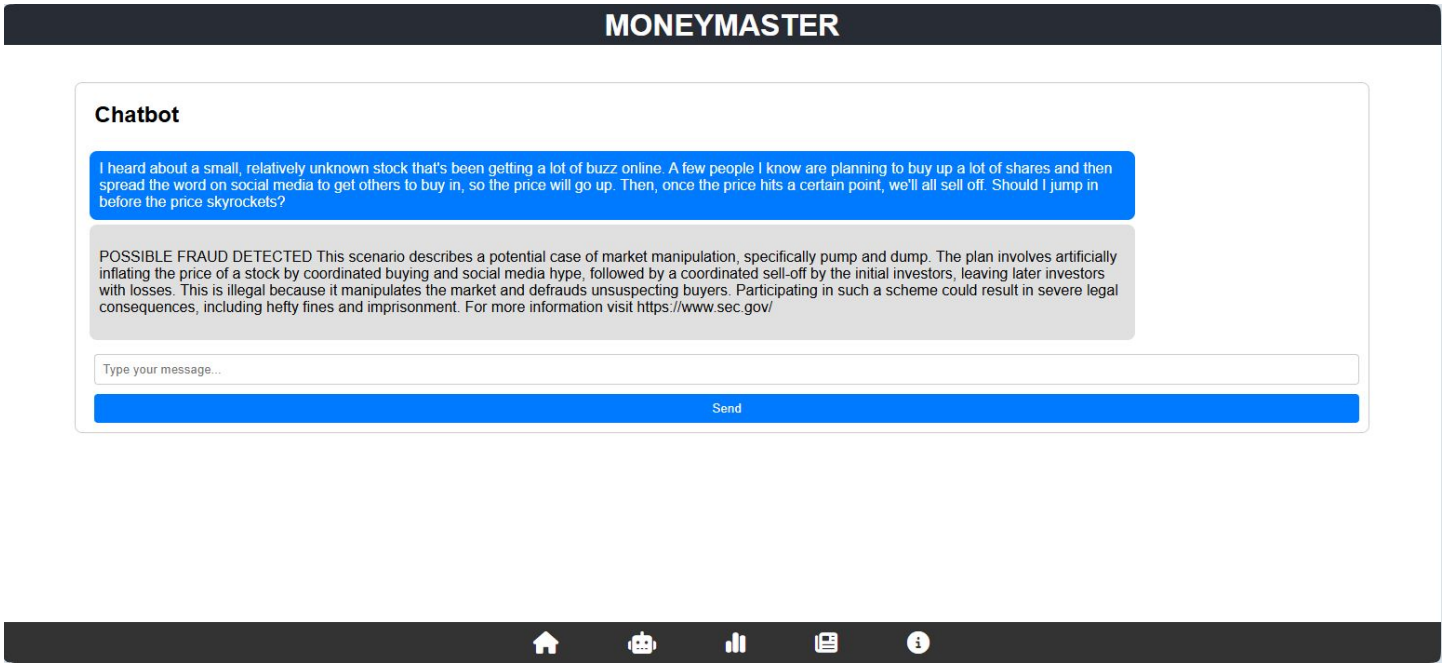
Model Architecture (SMP-DL)

```
features = ['Open', 'High', 'Low', 'Close', 'Volume', 'RSI14', 'SMA30', 'Deviation']
model = Sequential()
model.add(LSTM(25, return_sequences=True, input_shape=(window_size, 8)))
model.add(Dropout(0.3))
model.add(LSTM(25))
model.add(Dropout(0.3))
model.add(Dense(1))
```

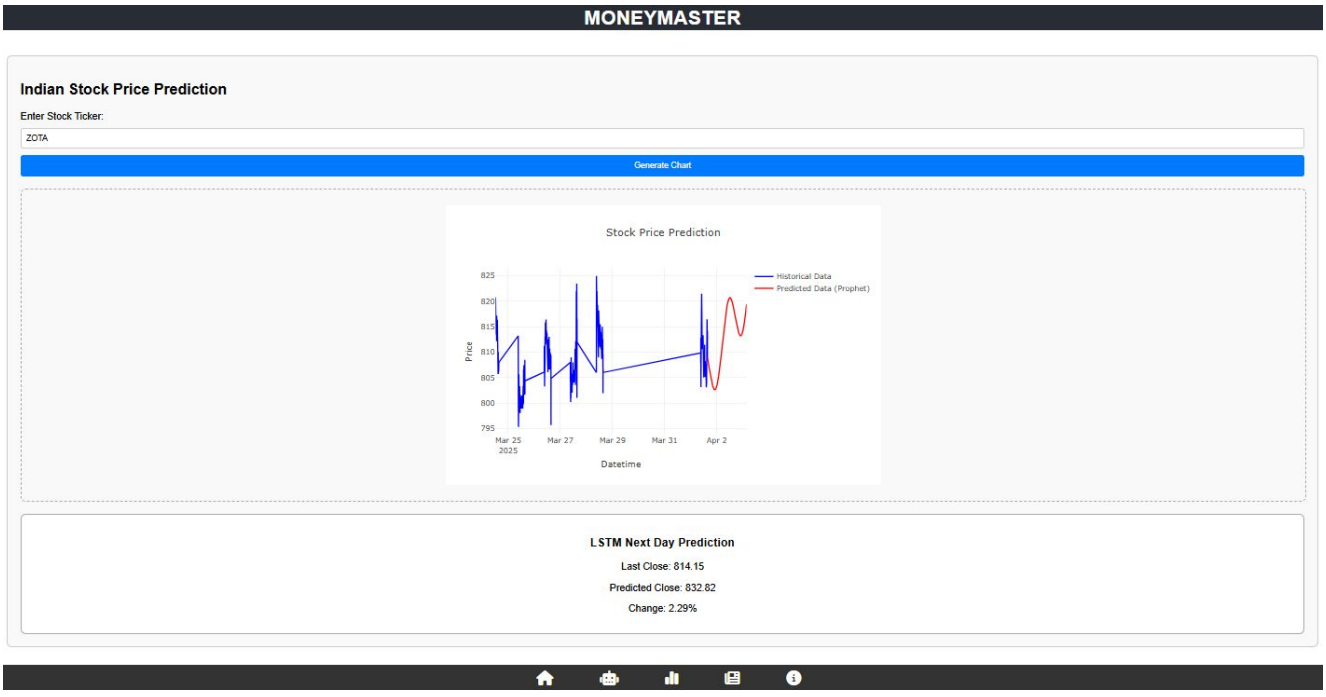

User Interface (Home Page)



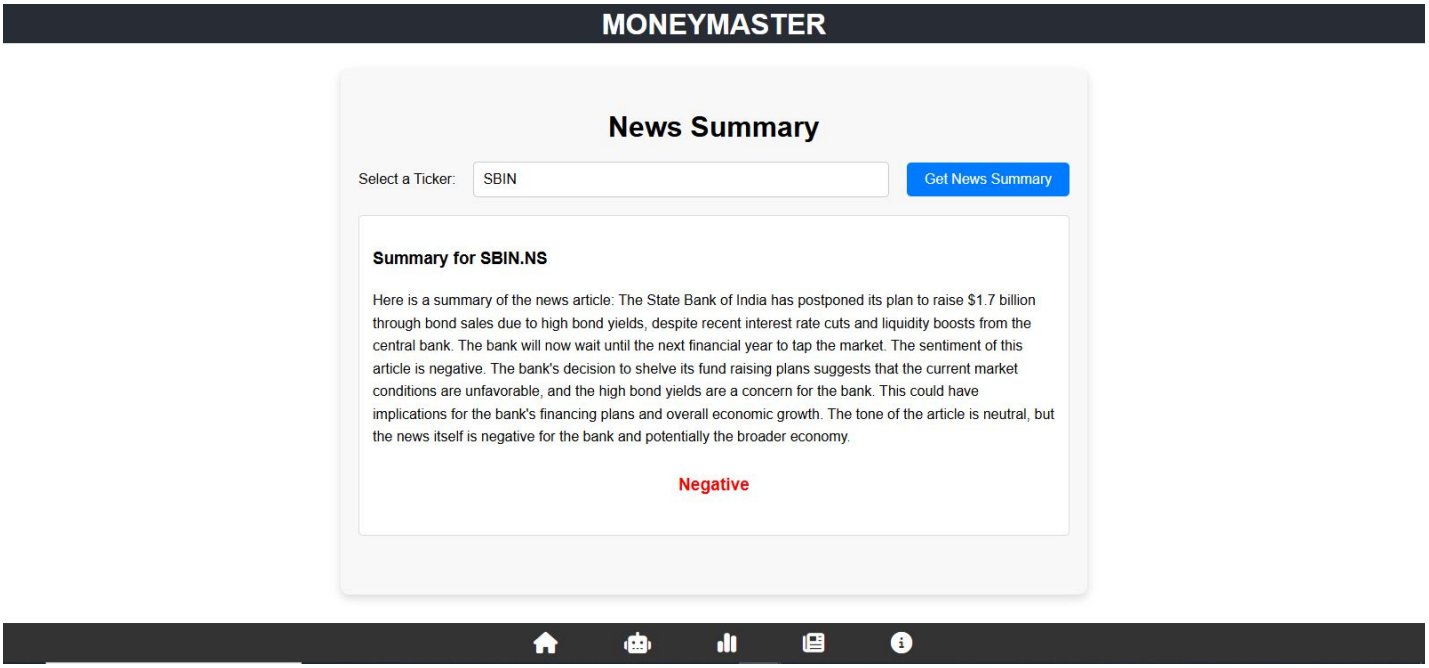
User Interface (Fraud detector)



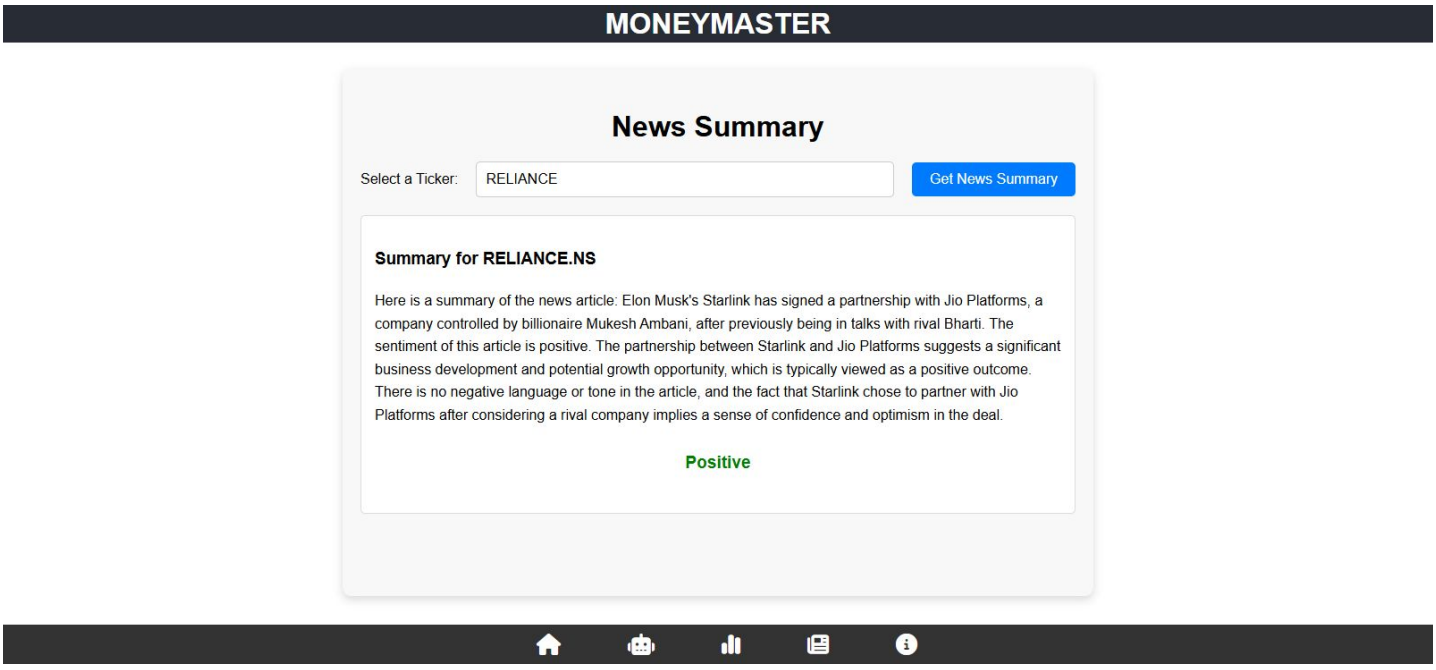
User Interface (Prediction Engine)



User Interface (Article Sentiment Detector)



User Interface



Conclusion

- MoneyMaster aims to simplify and enhance financial decision-making for both novice and experienced investors.
- By leveraging AI-driven stock predictions, personalized financial advice, real-time updates, and robust fraud detection, the app empowers users to make informed, secure, and strategic investments.
- With its user-friendly interface and powerful tools, MoneyMaster is positioned to be a valuable companion in navigating the complexities of the financial world, delivering a balance of guidance, protection, and insight..

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Thank You

Appendix B: Vision, Mission, Programme Outcomes and Course Outcomes

Vision, Mission, Programme Outcomes and Course Outcomes

Institute Vision

To evolve into a premier technological institution, moulding eminent professionals with creative minds, innovative ideas and sound practical skill, and to shape a future where technology works for the enrichment of mankind.

Institute Mission

To impart state-of-the-art knowledge to individuals in various technological disciplines and to inculcate in them a high degree of social consciousness and human values, thereby enabling them to face the challenges of life with courage and conviction.

Department Vision

To become a centre of excellence in Computer Science and Engineering, moulding professionals catering to the research and professional needs of national and international organizations.

Department Mission

To inspire and nurture students, with up-to-date knowledge in Computer Science and Engineering, ethics, team spirit, leadership abilities, innovation and creativity to come out with solutions meeting societal needs.

Programme Outcomes (PO)

Engineering Graduates will be able to:

1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering

problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and Team work: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

10. Communication: Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Programme Specific Outcomes (PSO)

A graduate of the Computer Science and Engineering Program will demonstrate:

PSO1: Computer Science Specific Skills

The ability to identify, analyze and design solutions for complex engineering problems in multidisciplinary areas by understanding the core principles and concepts of computer science and thereby engage in national grand challenges.

PSO2: Programming and Software Development Skills

The ability to acquire programming efficiency by designing algorithms and applying standard practices in software project development to deliver quality software products meeting the demands of the industry.

PSO3: Professional Skills

The ability to apply the fundamentals of computer science in competitive research and to develop innovative products to meet the societal needs thereby evolving as an eminent researcher and entrepreneur.

Course Outcomes (CO)

After the completion of the course the student will be able to:

Course Outcome 1: Model and solve real world problems by applying knowledge across domains (Cognitive knowledge level: Apply).

Course Outcome 2: Develop products, processes or technologies for sustainable and socially relevant applications (Cognitive knowledge level: Apply).

Course Outcome 3: Function effectively as an individual and as a leader in diverse teams and to comprehend and execute designated tasks (Cognitive knowledge level: Apply).

Course Outcome 4: Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms (Cognitive knowledge level: Apply).

Course Outcome 5: Identify technology/research gaps and propose innovative/cre-

ative solutions (Cognitive knowledge level: Analyze).

Course Outcome 6: Organize and communicate technical and scientific findings effectively in written and oral forms (Cognitive knowledge level: Apply).

Appendix C: CO-PO-PSO Mapping

COURSE OUTCOMES:

After completion of the course the student will be able to

SL.NO	DESCRIPTION	Blooms' Taxonomy Level
CO1	Model and solve real world problems by applying knowledge across domains (Cognitive knowledge level:Apply).	Level 3: Apply
CO2	Develop products, processes or technologies for sustainable and socially relevant applications. (Cognitive knowledge level:Apply).	Level 3: Apply
CO3	Function effectively as an individual and as a leader in diverse teams and to comprehend and execute designated tasks. (Cognitive knowledge level:Apply).	Level 3: Apply
CO4	Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms (Cognitive knowledge level: Apply).	Level 3: Apply
CO5	Identify technology/research gaps and propose innovative/creative solutions (Cognitive knowledge level:Analyze).	Level 4: Analyze
CO6	Organize and communicate technical and scientific findings effectively in written and oral forms (Cognitive knowledge level:Apply).	Level 3: Apply

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	2	1	2	2	2	1	1	1	1	2	3		
CO 2	2	2	2		1	3	3	1	1		1	1		2	
CO 3									3	2	2	1			3
CO 4					2			3	2	2	3	2			3
CO 5	2	3	3	1	2							1	3		
CO 6					2			2	2	3	1	1			3

3/2/1: high/medium/low

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/MEDIUM/HIGH	JUSTIFICATION
101003/ CS722U.1-PO1	M	Knowledge in the area of technology for project development using various tools results in better modeling.
101003/ CS722U.1-PO2	M	Knowledge acquired in the selected area of project development can be used to identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions.
101003/ CS722U.1-PO3	M	Can use the acquired knowledge in designing solutions to complex problems.
101003/ CS722U.1-PO4	M	Can use the acquired knowledge in designing solutions to complex problems.
101003/ CS722U.1-PO5	H	Students are able to interpret, improve and redefine technical aspects for design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
101003/ CS722U.1-PO6	M	Students are able to interpret, improve and redefine technical aspects by applying contextual knowledge to assess societal, health and consequential responsibilities relevant to professional engineering practices.
101003/ CS722U.1-PO7	M	Project development based on societal and environmental context solution identification is the need for sustainable development.
101003/ CS722U.1-PO8	L	Project development should be based on professional ethics and responsibilities.

101003/ CS722U.1-PO9	L	Project development using a systematic approach based on well defined principles will result in teamwork.
101003/ CS722U.1-PO10	M	Project brings technological changes in society.
101003/ CS722U.1-PO11	H	Acquiring knowledge for project development gathers skills in design, analysis, development and implementation of algorithms.
101003/ CS722U.1-PO12	H	Knowledge for project development contributes engineering skills in computing & information gatherings.
101003/ CS722U.2-PO1	H	Knowledge acquired for project development will also include systematic planning, developing, testing and implementation in computer science solutions in various domains.
101003/ CS722U.2-PO2	H	Project design and development using a systematic approach brings knowledge in mathematics and engineering fundamentals.
101003/ CS722U.2-PO3	H	Identifying, formulating and analyzing the project results in a systematic approach.
101003/ CS722U.2-PO5	H	Systematic approach is the tip for solving complex problems in various domains.
101003/ CS722U.2-PO6	H	Systematic approach in the technical and design aspects provide valid conclusions.

101003/ CS722U.2-PO7	H	Systematic approach in the technical and design aspects demonstrate the knowledge of sustainable development.
101003/ CS722U.2-PO8	M	Identification and justification of technical aspects of project development demonstrates the need for sustainable development.
101003/ CS722U.2-PO9	H	Apply professional ethics and responsibilities in engineering practice of development.
101003/ CS722U.2-PO11	H	Systematic approach also includes effective reporting and documentation which gives clear instructions.
101003/ CS722U.2-PO12	M	Project development using a systematic approach based on well defined principles will result in better teamwork.
101003/ CS722U.3-PO9	H	Project development as a team brings the ability to engage in independent and lifelong learning.
101003/ CS722U.3-PO10	H	Identification, formulation and justification in technical aspects will be based on acquiring skills in design and development of algorithms.
101003/ CS722U.3-PO11	H	Identification, formulation and justification in technical aspects provides the betterment of life in various domains.
101003/ CS722U.3-PO12	H	Students are able to interpret, improve and redefine technical aspects with mathematics, science and engineering fundamentals for the solutions of complex problems.

101003/ CS722U.4-PO5	H	Students are able to interpret, improve and redefine technical aspects with identification formulation and analysis of complex problems.
101003/ CS722U.4-PO8	H	Students are able to interpret, improve and redefine technical aspects to meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
101003/ CS722U.4-PO9	H	Students are able to interpret, improve and redefine technical aspects for design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
101003/ CS722U.4-PO10	H	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools for better products.
101003/ CS722U.4-PO11	M	Students are able to interpret, improve and redefine technical aspects by applying contextual knowledge to assess societal, health and consequential responsibilities relevant to professional engineering practices.
101003/ CS722U.4-PO12	H	Students are able to interpret, improve and redefine technical aspects for demonstrating the knowledge of, and need for sustainable development.
101003/ CS722U.5-PO1	H	Students are able to interpret, improve and redefine technical aspects, apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
101003/ CS722U.5-PO2	M	Students are able to interpret, improve and redefine technical aspects, communicate effectively on complex engineering activities with the engineering community and with society at

		large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
101003/ CS722U.5-PO3	H	Students are able to interpret, improve and redefine technical aspects to demonstrate knowledge and understanding of the engineering and management principle in multidisciplinary environments.
101003/ CS722U.5-PO4	H	Students are able to interpret, improve and redefine technical aspects, recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
101003/ CS722U.5-PO5	M	Students are able to interpret, improve and redefine technical aspects in acquiring skills to design, analyze and develop algorithms and implement those using high-level programming languages.
101003/ CS722U.5-PO12	M	Students are able to interpret, improve and redefine technical aspects and contribute their engineering skills in computing and information engineering domains like network design and administration, database design and knowledge engineering.
101003/ CS722U.6-PO5	M	Students are able to interpret, improve and redefine technical aspects and develop strong skills in systematic planning, developing, testing, implementing and providing IT solutions for different domains which helps in the betterment of life.
101003/ CS722U.6-PO8	H	Students will be able to associate with a team as an effective team player for the development of technical projects by applying the knowledge of mathematics, science, engineering

		fundamentals, and an engineering specialization to the solution of complex engineering problems.
101003/ CS722U.6-PO9	H	Students will be able to associate with a team as an effective team player for Identify, formulate, review research literature, and analyze complex engineering problems
101003/ CS722U.6-PO10	M	Students will be able to associate with a team as an effective team player for designing solutions to complex engineering problems and design system components.
101003/ CS722U.6-PO11	M	Students will be able to associate with a team as an effective team player use research-based knowledge and research methods including design of experiments, analysis and interpretation of data.
101003/ CS722U.6-PO12	H	Students will be able to associate with a team as an effective team player, applying ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
101003/ CS722U.1-PSO1	H	Students are able to develop Computer Science Specific Skills by modeling and solving problems.
101003/ CS722U.2-PSO2	M	Developing products, processes or technologies for sustainable and socially relevant applications can promote Programming and Software Development Skills.
101003/ CS722U.3-PSO3	H	Working in a team can result in the effective development of Professional Skills.

101003/ CS722U.4-PSO3	H	Planning and scheduling can result in the effective development of Professional Skills.
101003/ CS722U.5-PSO1	H	Students are able to develop Computer Science Specific Skills by creating innovative solutions to problems.
101003/ CS722U.6-PSO3	H	Organizing and communicating technical and scientific findings can help in the effective development of Professional Skills.