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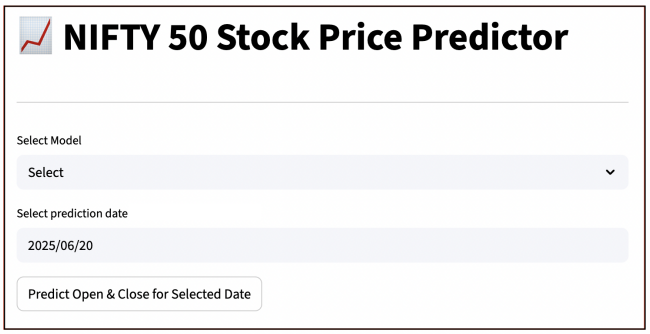
Manual

Nifty 50 Stock price Prediction Using ARIMA and LSTM modelsl



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Acronyms

1 Overview

This **NIFTY 50 Stock Price Predictor** delivers a interactive web application for time series forecasting of The National Stock Exchange Fifty(NIFTY 50) index using two widely adopted models: AutoRegressive Integrated Moving Average (ARIMA) and Long Short-Term Memory (LSTM) neural network. Built with Streamlit, the application allows users to make stock price predictions with minimal technical setup.

It offers two primary modes of use:

- **Next-day prediction** of **Open and Close prices** using historical data fetched live from Yahoo Finance.
- **Backtesting and analysis** by selecting any historical date and comparing model predictions to actual prices.

Key features of the application include:

- Dual-model support: AutoRegressive Integrated Moving Average (ARIMA) for statistical modeling and Long Short-Term Memory (LSTM) for deep learning-based forecasting.
- Simultaneous prediction for both `Open` and `Close` stock prices.
- Automatic data acquisition from Yahoo Finance via the `yfinance` API (Application Programming Interface) for maximum recency and convenience.
- Display of evaluation metrics, including Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE), to provide users with interpretable measures of prediction reliability.
- Graphical comparison between predicted and actual values using interactive time series plots.
- Summary tables that contextualize predictions within statistical confidence ranges based on recent performance.

This **NIFTY 50 Stock Price Predictor** is intended for analysts, researchers, and enthusiasts who wish to apply machine learning (ML) and statistical models for financial forecasting, without needing to write code or build complex environments. The National Stock Exchange Fifty(NIFTY 50) index, being India's most recognized benchmark stock index, makes this tool particularly valuable for studying market behavior, validating trading strategies, or educational demonstrations in time series modeling.

2 Installation

2.1 System Requirements

The **NIFTY 50 Stock Price Predictor** application is delivered as a cloud-hosted, web-based platform, accessible through any modern web browser. To ensure smooth usage and real-time responsiveness, users should access the application from a device with a stable internet connection, particularly when handling large data queries or generating detailed visualizations.

The application has been tested for compatibility with recent versions of major browsers, including:

- **Google Chrome** (version 110 and above)
- **Mozilla Firefox** (version 100 and above)
- **Microsoft Edge** (version 110 and above)

It functions reliably across the following operating systems:

- **Windows:** Version 10 (22H2) and Version 11 (23H2) or later
- **macOS:** Version 13 (Ventura), Version 14 (Sonoma), or later
- **Linux:** Ubuntu 22.04 LTS, Fedora 38+, and other distributions supporting Chromium-based browsers or Firefox

While the application is accessible on mobile devices, full functionality and optimal performance are best experienced on desktop or laptop environments.

2.2 Accessing the Application

To use the **NIFTY 50 Stock Price Predictor** application:

1. Visit the deployed web application at https://nifty50indexprediction.streamlit.app/.
2. Open the link in a supported browser to load the user interface.
3. Interact with the application by selecting a prediction model, choosing a date, and viewing the results in real time.

No registration or sign-in is required for standard use, unless access restrictions are configured for organizational deployment. The browser interface replicates the look and feel of a desktop dashboard, providing users with immediate access to forecasting tools, evaluation metrics such as Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE), and dynamic visualizations. All outputs are generated on demand and do not require local data storage or computation.

3 Functions and Features

3.1 Graphical User Interface (GUI)

The Stock Predictor application features a modern, browser-based Graphical User Interface (GUI) that is designed to be intuitive and responsive. The layout allows users to interact with forecasting models in a visually guided manner without requiring any technical background.

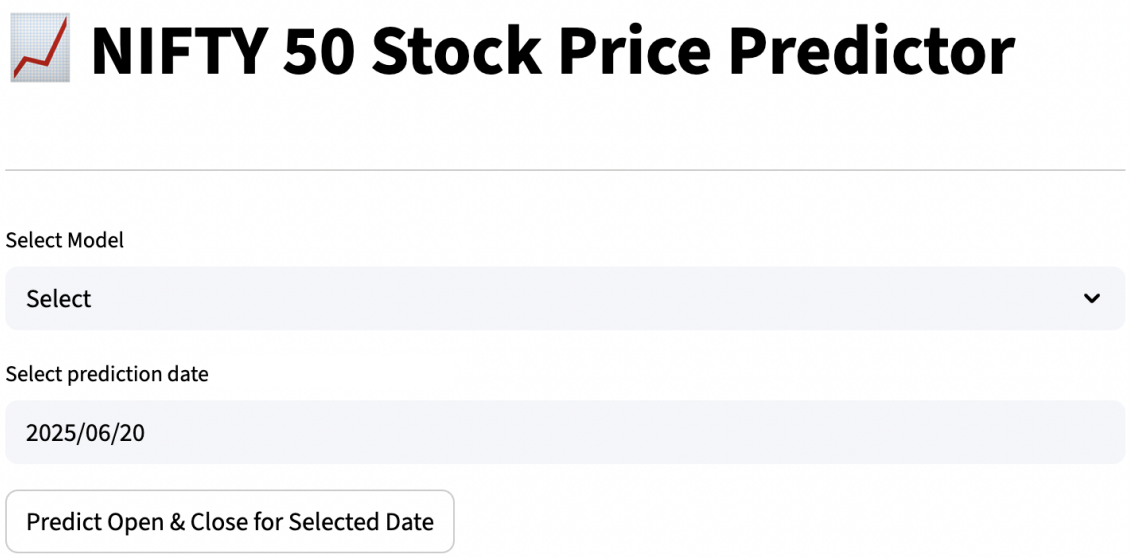


Figure 3.1: GUI

3.2 Functional Controls and Interactivity

The application interface includes several interactive elements that allow users to operate the system efficiently and intuitively. Each control has been designed with a clear function:

3.2.1 Model Selection Dropdown

Enables the user to choose between the available forecasting models: Long Short-Term Memory (LSTM) or AutoRegressive Integrated Moving Average (ARIMA). The selected model determines the forecasting strategy to be executed.

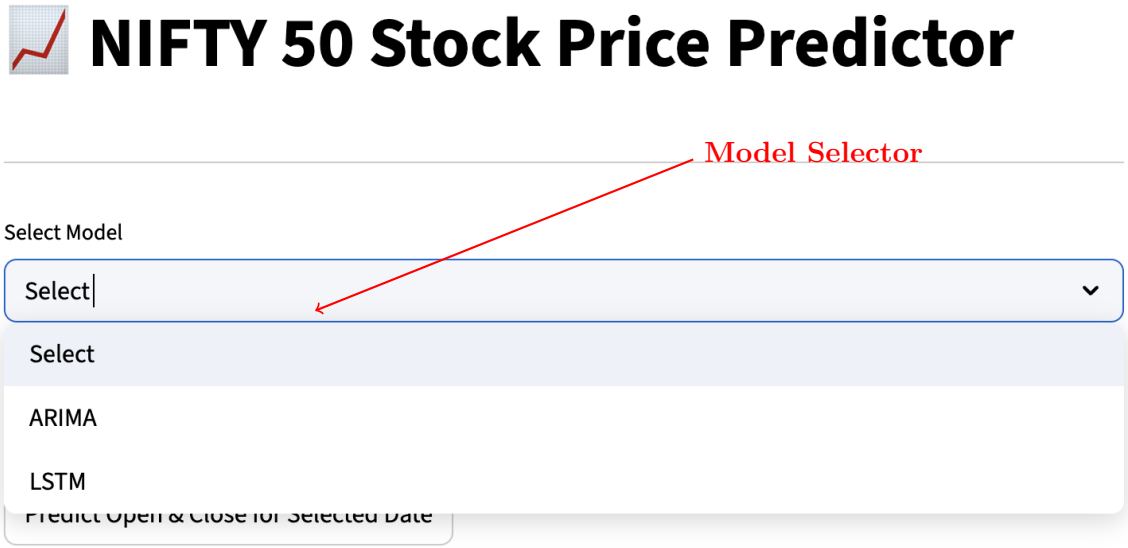


Figure 3.2: Model Selector

3.2.2 Date Picker Calendar

Provides users with a scrollable calendar to select the date for prediction. The system enforces strict constraints to maintain data integrity:

- **Historical Forecasting:** Users can select any past trading date from the year 2008 onwards for backtesting and analysis.

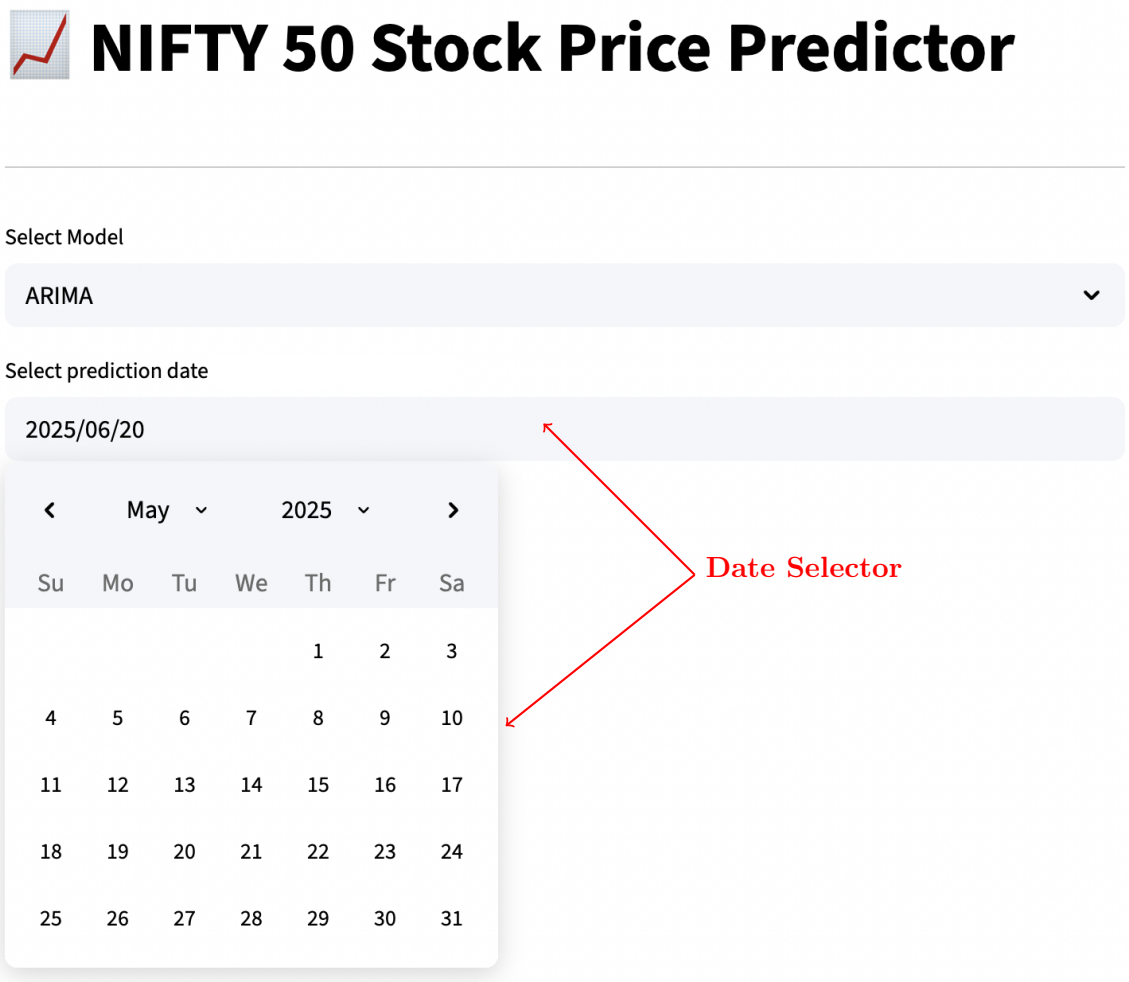


Figure 3.3: Date Picker Calendar

- **Forward Prediction:** Only the next available trading day (typically tomorrow) is enabled for forecasting future prices. All dates beyond tomorrow are disabled to prevent unsupported predictions. Similarly, weekends and non-trading days are automatically excluded.

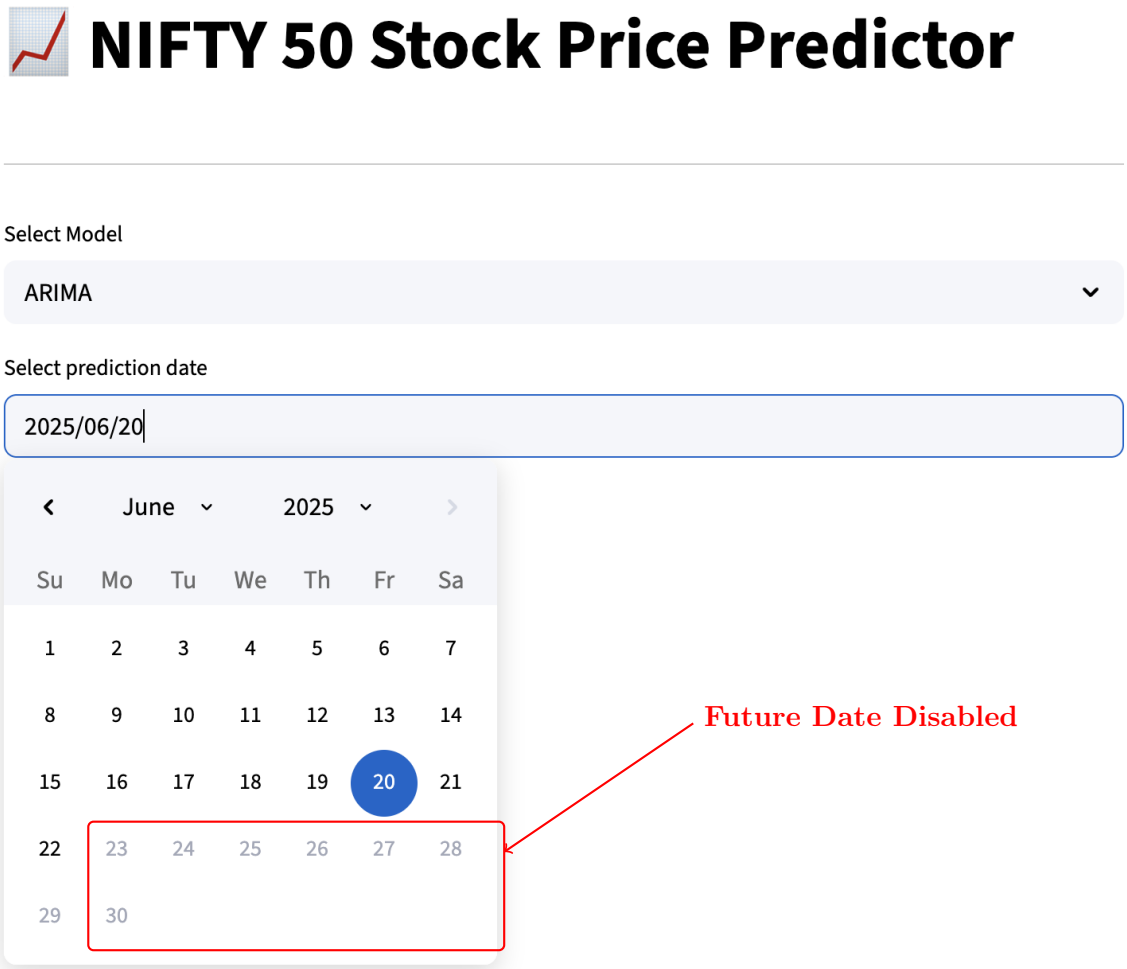


Figure 3.4: Future Date Disabled

- **Date Restriction:** All the Saturday and Sundays are disabled as it is considered as non trading days. The below red bar is displayed , which states that the user has selected a Weekend and needs to select a Weekday to proceed with the prediction.

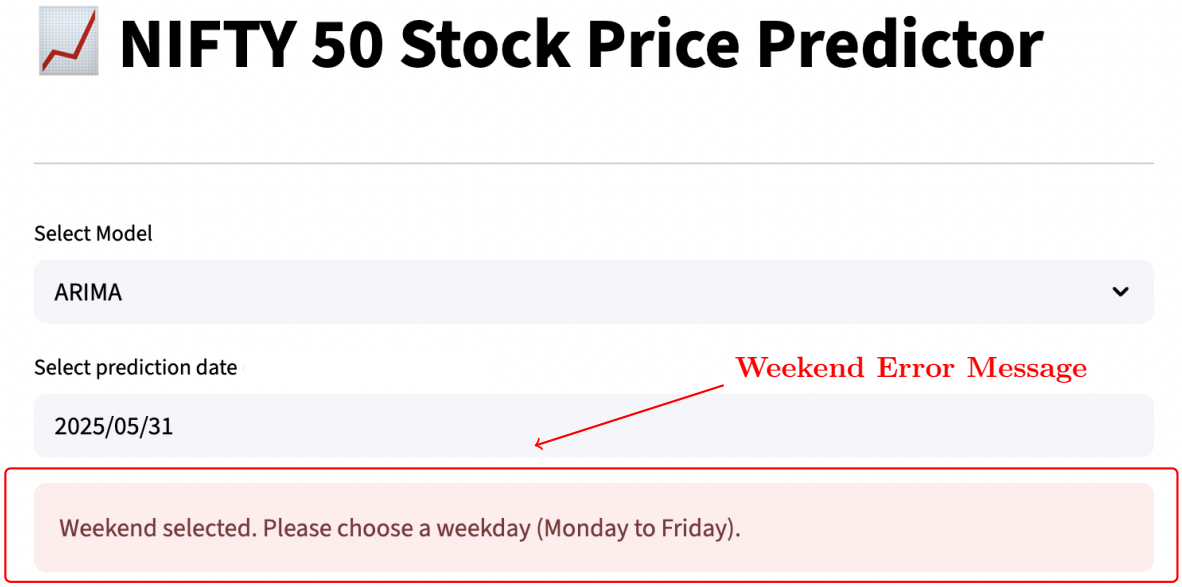


Figure 3.5: Weekend Selection

3.2.3 Prediction Trigger

– This control executes the selected forecasting model using the most recent market data. Upon activation, the system performs model inference and displays predicted prices, evaluation metrics, and visual plots on the interface.

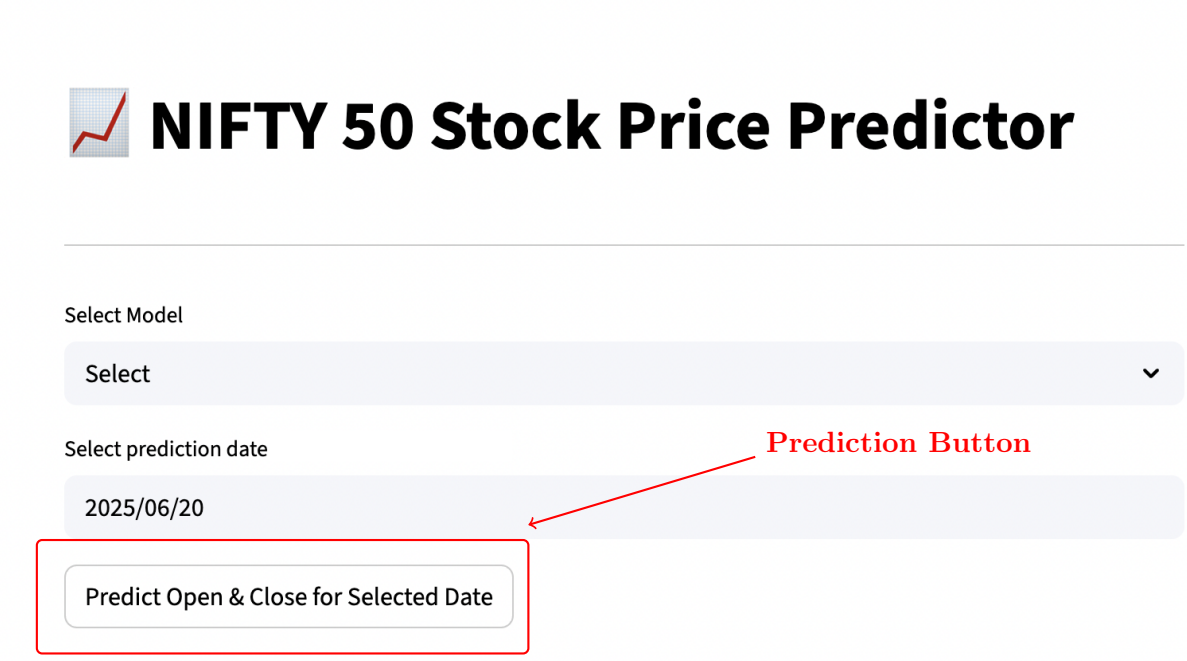


Figure 3.6: Prediction Trigger Button

3.2.4 Confirmation of Model running

Once the Model is selected and the date for prediction is selected as well and when we hit the "**Predict Open & Close for selected Date**" button , we can see few sporty symbols on top which indicates that the model is running on the backend , and there is an option to stop the run midway by clicking the **stop** button next to the **sporty** symbol on the top.

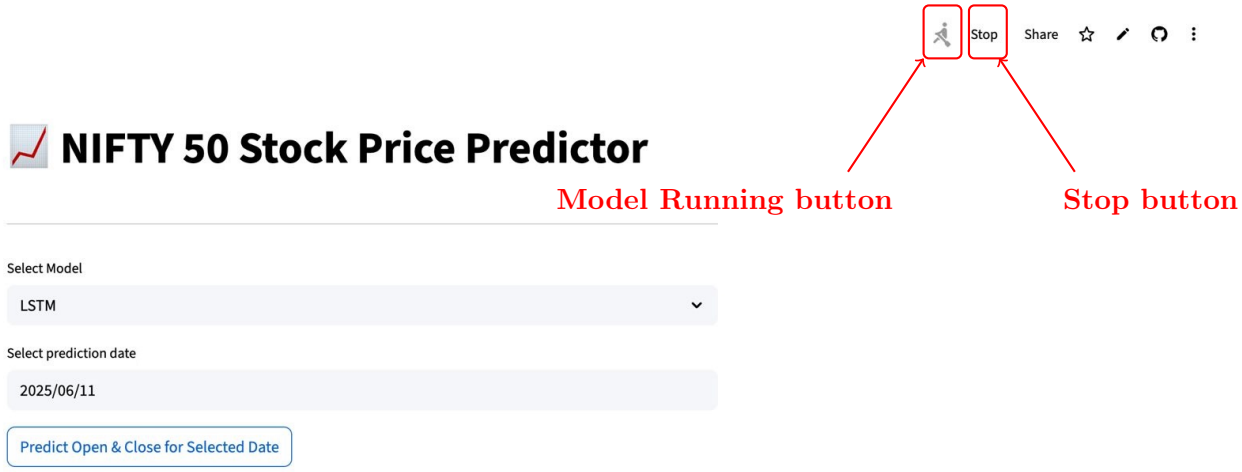


Figure 3.7: Model Running

3.3 Interactive Output and Evaluation Feedback

Once a prediction is generated, the results are immediately shown in the interface right below the **Predict trigger button**. The following output information is presented in the Interface:

3.3.1 Open price prediction and Close price prediction :

If the selected date is a historical date then the output will show a predicted Open and closing price value along with the actual open and close price values. If the selected date is the future date , that is the next day prediction , then the output in the interface will only be of the predicted open and closing price values as the actual value is not available from the Yahoofinance API.

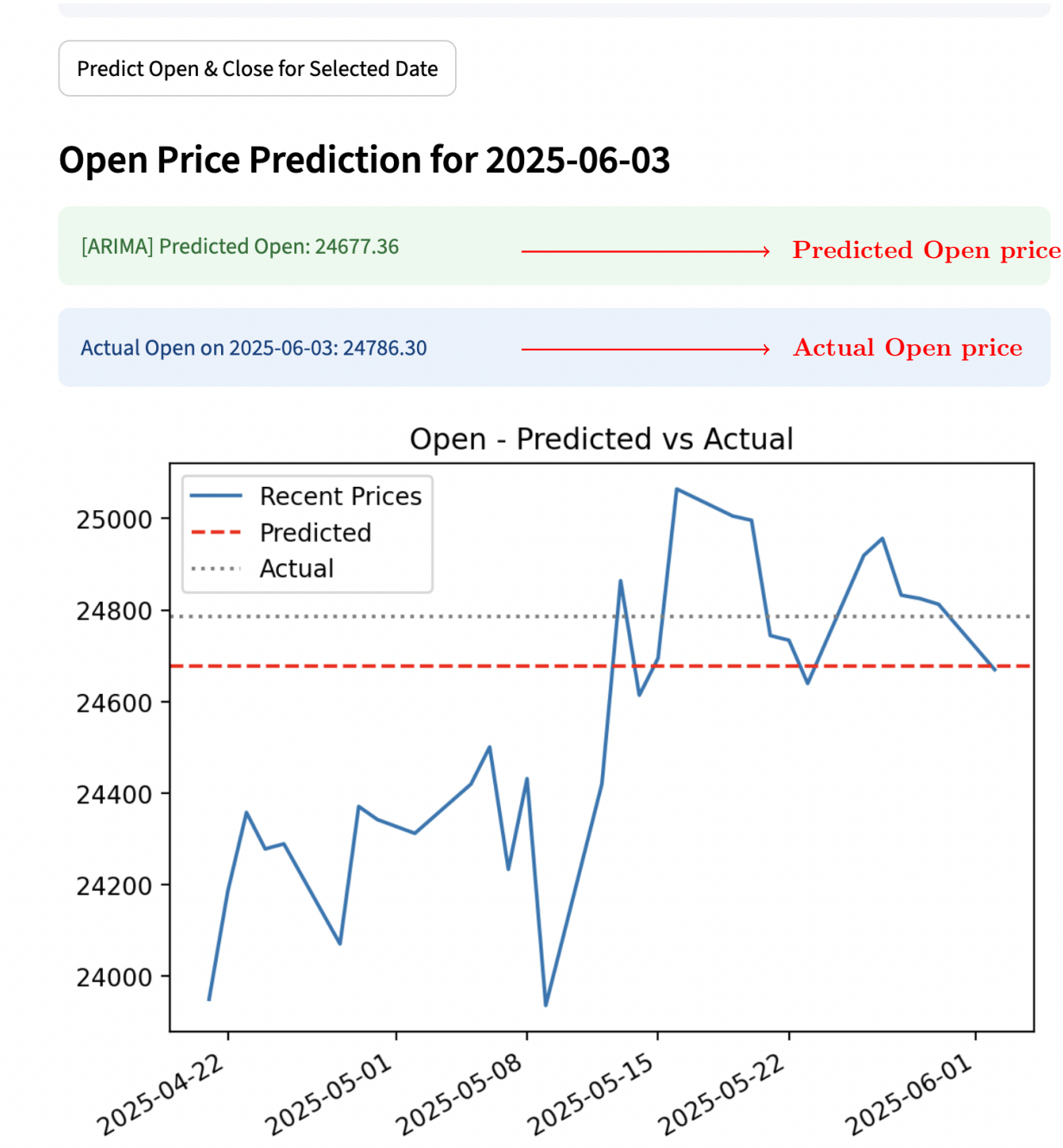


Figure 3.8: Open Price Prediction with graph

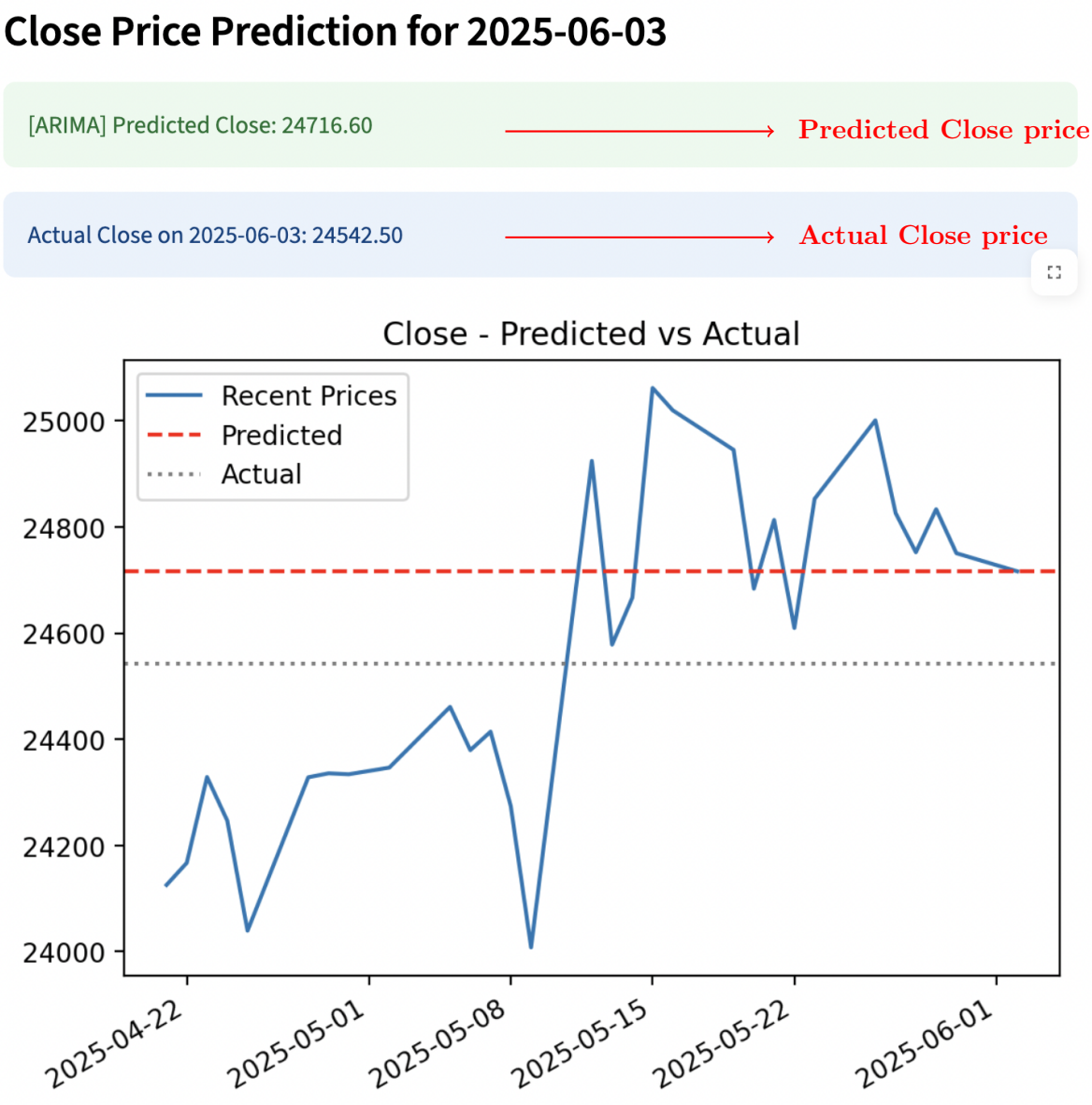
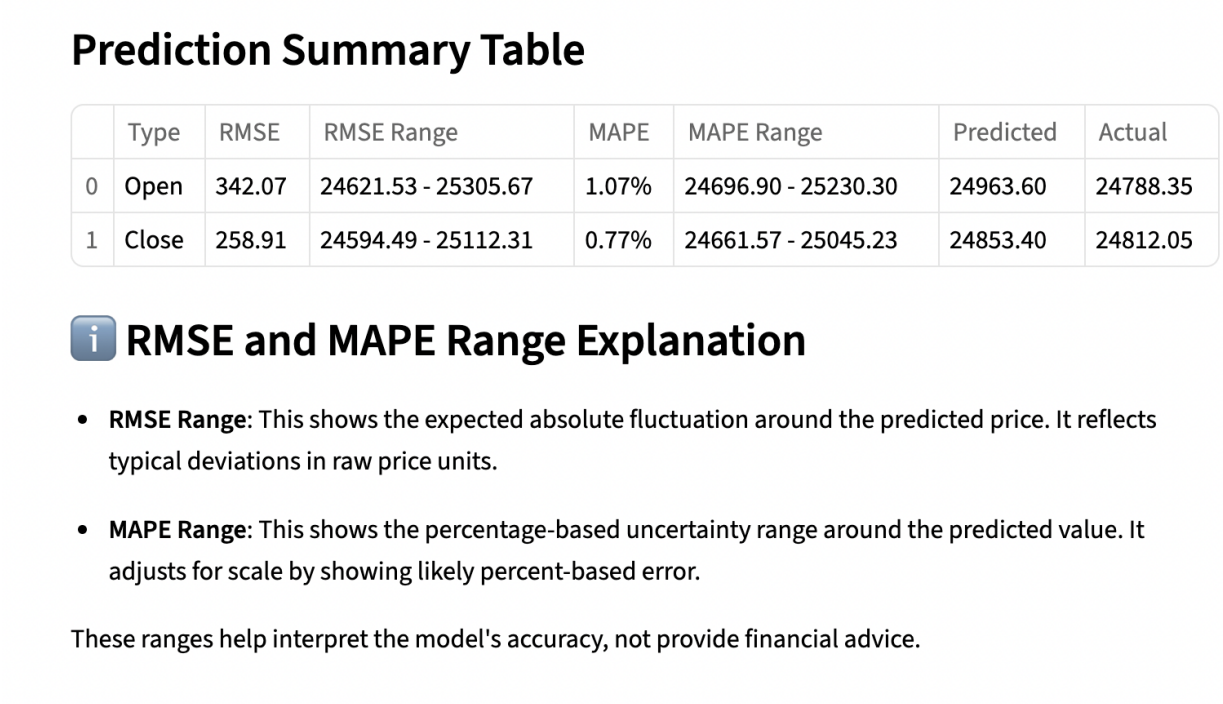


Figure 3.9: Close Price Prediction with graph

3.3.2 Evaluation Metrics :

The model's performance is assessed using evaluation metrics such as Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE). Prediction intervals derived from these metrics are displayed beneath the main results. A detailed explanation of the evaluation metrics is provided at the end of this document.



Prediction Summary Table

	Type	RMSE	RMSE Range	MAPE	MAPE Range	Predicted	Actual
0	Open	342.07	24621.53 - 25305.67	1.07%	24696.90 - 25230.30	24963.60	24788.35
1	Close	258.91	24594.49 - 25112.31	0.77%	24661.57 - 25045.23	24853.40	24812.05

ℹ️ RMSE and MAPE Range Explanation

- **RMSE Range**: This shows the expected absolute fluctuation around the predicted price. It reflects typical deviations in raw price units.
- **MAPE Range**: This shows the percentage-based uncertainty range around the predicted value. It adjusts for scale by showing likely percent-based error.

These ranges help interpret the model's accuracy, not provide financial advice.

Figure 3.10: Evaluation Metrics

3.3.3 Integrated Logging and Notifications

Instead of traditional log files, the cloud application provides in-app error messages to alert users of data validation issues, model selection warnings, or connectivity errors. This helps users troubleshoot common problems without needing access to system logs or backend infrastructure.

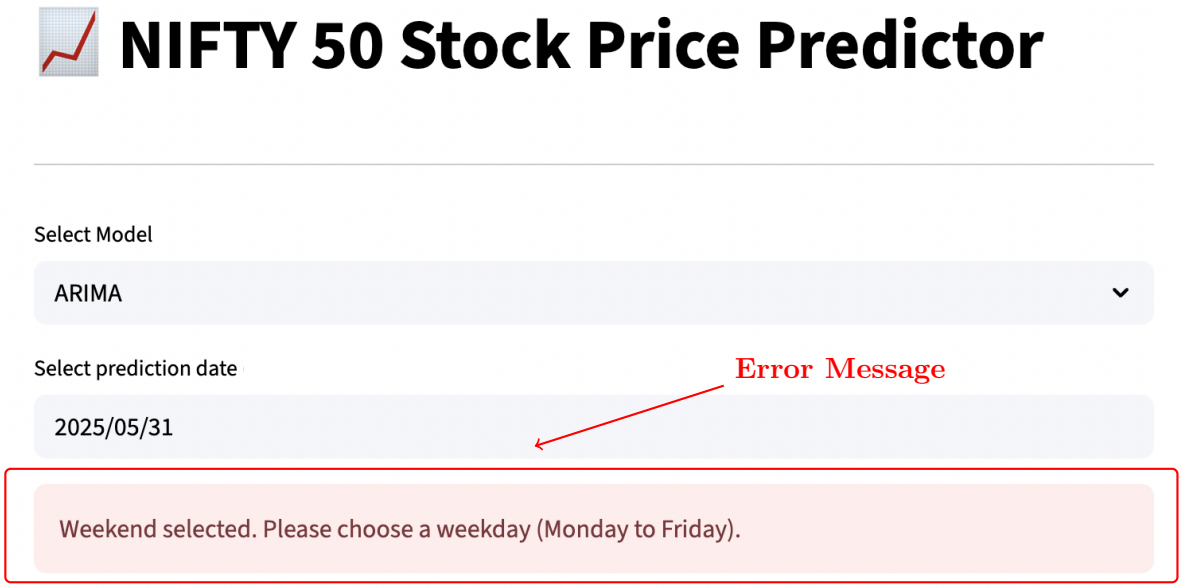


Figure 3.11: Example Error Message

4 First Step

4.1 Getting Started with Prediction

The **NIFTY 50 Stock Price Predictor** application is hosted on a secure cloud platform and can be accessed directly through any supported web browser at https://nifty50indexpredictio No installation or setup is required. Once the user opens the application URL, the interface is ready for immediate use.

4.1.1 Step 1: Select a Prediction Date

Use the interactive calendar widget labeled **Select a Date** to choose the day for which you want to forecast stock prices.

- For historical analysis, users can select any date starting from Jan 2008 up to the present.
- For future prediction, only the next available trading day (usually tomorrow) is selectable. All other future dates remain disabled to prevent invalid inputs.
- If the selected date is a weekend or market holiday, the system will display a notification prompting the user to pick a valid trading day.

4.1.2 Step 2: Choose a Forecasting Model

From the **Select Model** dropdown menu, choose one of the available prediction models:

- **LSTM (Long Short-Term Memory):** A deep learning model that uses historical stock data and multiple financial indicators for multivariate prediction.
- **ARIMA (AutoRegressive Integrated Moving Average):** A statistical model that predicts future values based on trend and autocorrelation in the time series.

4.1.3 Step 3: Run the Prediction

After selecting both the date and the model, click the **Predict Open & Close for Selected Date** button to initiate the forecasting process. The application will fetch and process the necessary data, run the model on cloud servers, and return the open and close vlaues within seconds.

4.1.4 Step 4: View Results

The forecasted values are displayed immediately after execution:

- **Predicted Opening and Closing Prices** for the selected date.
- **Actual Prices** (only for historical stock data).
- **Evaluation Metrics:** Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE), comparing predictions to actual values if available.
- **Performance Summary:** A table comparing RSME and MAPE data range for the selcted algorithm is shown.

5 Module Evaluation Metrics

Both models are evaluated using two primary metrics that quantify prediction performance: Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE). These metrics are widely accepted in time series forecasting and financial prediction tasks.

Metric	Description
RMSE (Root Mean Squared Error)	Measures the square root of the average squared differences between predicted and actual values. RMSE penalizes larger errors more than smaller ones. Values close to zero indicate better accuracy. For stock prices, an RMSE below 120 points is typically acceptable, and below 100 is considered good.
MAPE (Mean Absolute Percentage Error)	Represents the average absolute error as a percentage of the actual value, making it scale-independent. For financial time series, a MAPE below 2% is considered acceptable, and below 1.2% is considered excellent.

Table 5.1: Evaluation metrics used for model performance

To determine which model performs better, the evaluation metrics can be compared across models. Below is a sample output showing RMSE and MAPE values for the ARIMA and LSTM models:

Model	RMSE (points)	MAPE (%)
ARIMA	113.67 (Acceptable)	1.21% (Excellent)
LSTM	101.45 (Good)	1.05% (Excellent)

Table 5.2: Sample Evaluation Metric Output with Interpretations

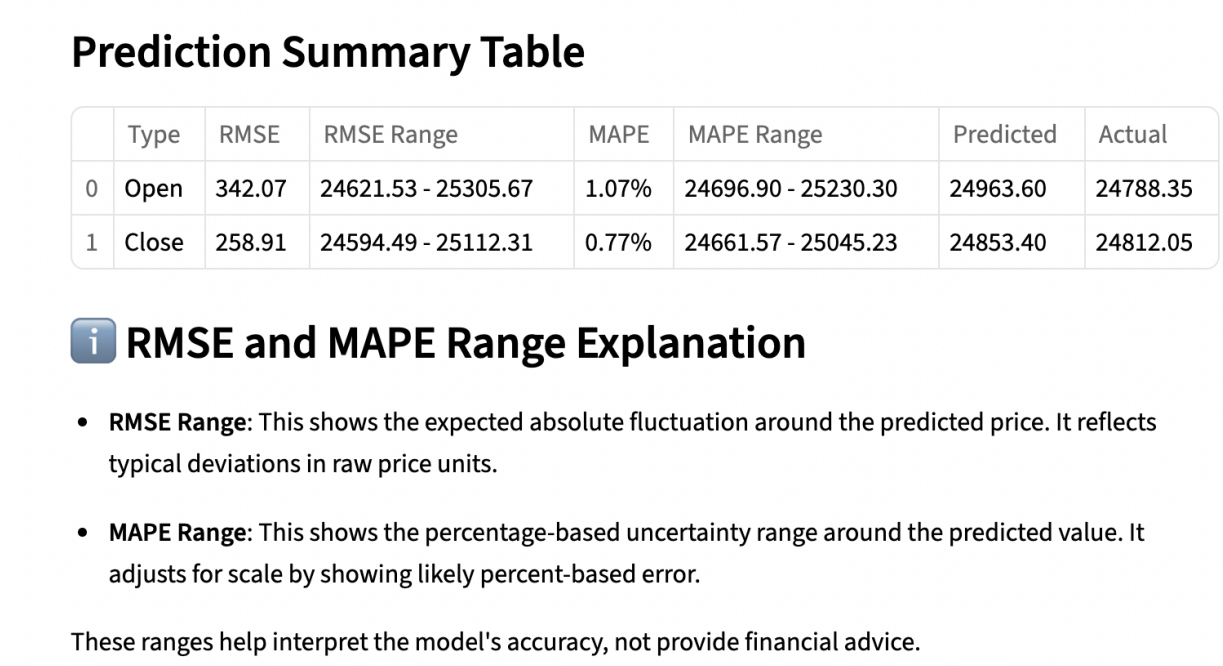
Interpretation Scale:

- **RMSE (Root Mean Squared Error):**
  - Excellent: <100 points
  - Good: 100–110 points
  - Acceptable: 110–120 points
  - Poor: >120 points
- **MAPE (Mean Absolute Percentage Error):**
  - Excellent: <1.20%

- Good: 1.20–1.50%
- Acceptable: 1.50–2.00%
- Poor: >2.00%

5.1 Understanding the Metrics (Example: LSTM)

- An RMSE of 101.45 means that on average, the predicted stock price differs from the actual value by about 101 index points. Since this value falls below the 120-point threshold, the prediction is considered reliable.
- A MAPE of 1.05% indicates that the predictions deviate by only 1.05% from the true values, which is excellent and falls well within the high-accuracy range.
- In this example, the LSTM model demonstrates superior performance by achieving lower RMSE and MAPE values compared to the ARIMA model. This indicates that LSTM provides more accurate and consistent stock price predictions, making it the more reliable choice for this dataset.



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These ranges help interpret the model's accuracy, not provide financial advice.

Figure 5.1: Model Comparison Based on RMSE and MAPE

6 Maintenance

6.1 System Monitoring and Logging

The cloud-hosted Stock Predictor application includes an integrated monitoring system to ensure stability, detect anomalies, and support issue resolution.

6.1.1 Purpose

The internal monitoring infrastructure records key application events such as model executions, forecasting outcomes, and system-level errors. This functionality is critical for identifying issues related to data access, prediction anomalies, or service disruptions. It also supports diagnostic reviews by the development team to improve future performance and robustness.

6.1.2 User Visibility

Users receive immediate feedback through on-screen alerts or informational messages within the Graphical User Interface (GUI). These notifications cover scenarios such as invalid date selections, unavailable data, or missing model selections. In case of a critical failure, a descriptive error message is displayed to guide the user without exposing technical details.

6.2 Application Updates

The **NIFTY 50 Stock Price Predictor** application is maintained through a centralized deployment system that ensures all users operate on the most recent and stable version. Since the application is web-based, updates are handled automatically on the server side.

6.2.1 Update Lifecycle

Improvements to model accuracy, performance enhancements, interface changes, and bug fixes are deployed periodically. Updates do not require any action from the user. Once changes are published to the cloud environment, all users accessing the platform benefit from the enhancements in real time.

7 Troubleshooting

7.1 Application Fails to Load in Browser

If the application does not load properly or remains stuck on the initial screen:

- A slow or unstable internet connection may prevent the application from retrieving data.
- The browser may be using an unsupported version or have JavaScript disabled.
- Temporary server issues may affect availability.

7.2 Recommended Actions

- Ensure you are connected to a reliable internet network.
- Use a supported and updated web browser such as Google Chrome, Mozilla Firefox, or Microsoft Edge.
- Refresh the browser page or clear the cache and try again after a few minutes.
- If the issue persists, check for platform-specific service announcements.

7.3 Prediction Does Not Trigger

If clicking the **Predict Open & Close for Selected Date** button does not produce any output:

- No forecasting model has been selected.
- An invalid date was chosen (e.g., a weekend or a public holiday).

7.4 Suggested Fixes

- Select a valid model from the dropdown list, either Long Short-Term Memory (LSTM) or AutoRegressive Integrated Moving Average (ARIMA).
- Make sure the selected date corresponds to a valid trading day.

7.5 Unexpected or Missing Results

If the predicted values appear to be incorrect or are not displayed at all:

- The selected date may be too close to the current day, leading to insufficient prior data.
- For LSTM forecasts, the required input sequence of 60 prior trading days may not be available due to data gaps.
- The financial data provider may not have released data for the selected day yet.

7.6 Resolution Steps

- Choose a date that is at least one trading day ahead and well-supported by historical data.
- Prefer dates for which financial markets have already closed and official data is likely available.
- For Long Short-Term Memory (LSTM) forecasts, ensure at least 60 valid consecutive trading days precede the selected date.

7.7 Performance and Compatibility Issues

If the interface becomes slow, unresponsive, or visually distorted:

- The browser session may be overloaded with cached data or extensions.

7.8 Solutions

- Try restarting your browser or switching to a different supported browser.
- Close other tabs or applications running in the background to free up memory.

8 FAQs

8.1 Do I need to install Python or any other software to use this application?

No. The **NIFTY 50 Stock Price Predictor** is a fully cloud-hosted application that runs in a standard web browser. All computations, forecasting models, and data processing are handled on remote servers. Users do not need to install Python, libraries, or any additional software on their local machine.

8.2 Can I predict stock prices for any date?

Yes, within the range supported by the financial data provider. The application allows users to forecast prices for:

- Historical trading dates, for backtesting and model comparison (01/01/2008 - Next working day).
- The next available trading day, typically tomorrow, for forward-looking analysis.

Dates falling on weekends or market holidays are automatically excluded to ensure data validity.

8.3 Do I need to upload any stock data?

The **NIFTY 50 Stock Price Predictor** application automatically retrieves historical and current stock market data directly from a live financial data provider using the `yfinance` Python library. This eliminates the need for manual uploads, file formatting, or data validation by the user.

8.4 How do I know if the prediction was successful?

Once the **Predict Open & Close for Selected Date** button is clicked, the application immediately displays the following in the interface:

- Predicted values for both opening and closing prices.
- Actual observed values (if available for historical dates).

- Evaluation metrics such as Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE), along with corresponding confidence intervals.

If the prediction could not be completed (due to unavailable data or model constraints), the system will provide a clear notification.

8.5 Can I use my own forecasting models?

No. The **NIFTY 50 Stock Price Predictor** application is built around validated and pre-integrated forecasting models, including Long Short-Term Memory (LSTM) and AutoRegressive Integrated Moving Average (ARIMA). Custom models are not supported in the cloud-hosted version to maintain consistency, accuracy, and security across all users.

8.6 What should I do if the application freezes or stops responding?

If the **NIFTY 50 Stock Price Predictor** application becomes unresponsive:

- Refresh your browser and ensure your internet connection is stable.
- Try switching to a supported browser such as Google Chrome or Mozilla Firefox.
- If the issue persists, report it through the designated support contact.

8.7 Will the application receive updates?

Yes. Because the **NIFTY 50 Stock Price Predictor** application is deployed on a cloud platform, updates are managed centrally by the development team. Users automatically receive the latest improvements and new features without needing to install or download anything manually.