# Signal Prediction Platform in Bluechip Stocks with ML Algorithms

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# 1. Plan

The timetable for the project is as follows. There are ten titles in the project, three of which are milestones. Titles of project milesotones are underlined.

| Task | Deadline |
|---|---|
| Submit timetable | 21.10.2022 |
| Introduction | 28.10.2022 |
| Requirements | 11.11.2022 |
| Design, UML Diagrams | 17.11.2022 |
| Submit progress report | 27.11.2022 |
| Implementation | 09.12.2022 |
| Use Case | 16.12.2022 |
| Demo | 23.12.2022 |
| Documentation | 30.12.2022 |
| Submit final report and demo | 08.01.2023 |

## 2.  Introduction

Financial markets are divided into four main branches as banking sector, capital markets, insurance sector and factoring-leasing sectors. Although banking sectors dominate financial markets in developing countries, capital markets dominate other financial sectors due to the size and number of buy and sell side investment institutions and the high under asset management volumes of these institutions in developed economies.

In developed capital markets, the volume of derivatives and debt instruments is higher than other markets and instruments such as stock market, financial commodities, mutual funds, money market and banking products. However, considering both the spot volume of stocks and the volume of derivative financial products whose underlyings are spot single stocks or stock indices, it can be said that stocks have an important place among capital market products. In addition, stocks, which are the first product that comes to mind in the capital markets, are a showcase product in the financial sector.

Stock value estimation is one of the foremost, widely studied and difficult topics that attracts researchers from various fields along with political economy, history, finance, arithmetic and computing [1]. The main task of stock market forecasting is to determine the timing of stock trading. However, this estimation is very difficult due to the high volatility and non-linear relationships caused by short-term fluctuations in investment demand [2]. There are many techniques used to forecast stocks, including fundamental and technical analysis [3]. Many analysts and researchers have developed tools and techniques that predict stock price movements and help investors make the right decision [4]. The data, the frequency of the data, the variables used and the tools/methods of the techniques are important in the models for which market prices predict/forecast. In this study, the literature was examined from these aspects.

In prediction models, stock price data and index values data sets are generally used as variables [5]. In addition to price data, there are forecast models that use data such as volume, etc. In addition, the changes in the price series are taken into account in the predictions and logarithmic changes are used [6].

In models that make signal and price predictions, it can take different ranges as data frequency. In addition to the models that make intraday price predictions [7], there are also algorithms that make predictions by taking into account the closing prices at the end of the day [8, 9]]. Except for the closing prices at the end of the day, the in studies are available in which daily high-low prices and opening prices are used [10]. Traders are generally interested in intraday prices, while pension fund investors usually consider end-of-day prices.

Macroeconomic variables such as economic growth rate, interest rate, trade balance, exchange rate and currency [11] and technical analysis variables such as KD, RSI, BIAS, Williams percentage R, momentum and MACD are used in price forecast models [10, 12]. In the study examining the articles between 2000-2019 in which ML algorithms were used for price prediction, it was determined that 2173 unique variables consisting of stock market predictions, including technical indicators, macro-economic variables, and fundamental indicators were used [13].

In general, classic techniques such as technical, fundamental, time series, text based (sentiment) analysis as well as advanced prediction techniques such as machine learning (ML), deep learning (DL), reinforcement leraning (RL) and artifical intelligence (AI) are used in stock price prediction. Technical analysis is a technique that helps to understand the price behavior of stocks, their signals and important turning points in the market price and is widely used in market price prediction [14, 15]. Although successful results were obtained in time series predictions made according to the traditional ARIMA model for nonstationary and highly noisy stock prices [16], studies with neural network-based methods such as probabilistic neural network (PNN) yielded more successful results than traditional ARIMA, ARMA and GMM models [8, 16–18].

Due to this success in new techniques in recent years, algorithms based on advanced techniques such AI, DL, RL and ML have been developed instead of classical techniques such as technical analysis and time series [4, 19–21]. In a study on SP 500, it has been argued that ML techniques such as random forest, gradient boosted trees, artificial neural network and logistic regression gave very good results in estimating US stocks. In addition, it has been stated that these techniques give even more successful results in the stocks of financial sector institutions [22].

There are many studies on regression and its derivatives in the literature [3, 12, 23, 24] [11, 15, 16, i4]. However, among AI, DL, RL and ML techniques, SVM [5, 14, 18, 25, 26] and Neural Netwrok methods stand out as more successful methods than others. There are many studies in the literature showing that neural network based methods such as Artificial Neural Network (ANN) such as Modular Neural Network, ARIMA-based Neural Networks, Genetic Algorithm, Recurrent Network, Back propagation Network, Radial Basis Function, Branch Network, Functional Link Artificial Neural Network, Feed Forward Neural Network, Fuzzy Neural Network, give very successful results in price predictions of stocks [27–29].

Apart from the techniques mentioned above, market prices are also tried to be estimated with text-based models [4]. In these studies, it has been determined that the use of textual information in addition to numerical time series data increases the quality of the input [30]. In a study in which stock price estimation was made based on financial news, it was found that financial news is an effective indicator in price estimation [31].

## 2.1. Requirements

### 2.1.1. Authentication

- System only shall let the users whose names, surnames, usernames and passwords are predefined by the system.

- When the user go to the main page url, system shall display the login page and message as "Please enter your username and password".

- When the users enter the username and password fields correctly, system shall let the users to enter the platform.

- If the users enter the username and password fields incorrectly, system shall send error message as "Username/password is incorrect".

- If the users shall enter the username and password correctly, system shall send warning message as "Please enter your username and password".

- While users login into to the platform, when the user clicks logout button in the sidebar, system shall logout the user from the platform.

## 2.1.2. Sidebar

- When the users select or use filtering tools in the sidebar, system shall change the graphs and tables in the main page.

- When a user selects indices from select security menu by using radio buttons, system shall change the name of the below dropdown menu to "select indices" and add the indices list into these dropdown menu.

- When a user selects stocks from select security menu by using radio buttons, system shall change the name of the below dropdown menu to "select stocks" and add the stocks listed in the Istanbul Stock Exchange into these dropdown menu.

- In the above selections, system shall display the first element of the lists alphabetically.

- When a user select a date from end or start date fields, a monthly display of a calendar shall be displayed by the system.

- When a user select the period by changing the end and start date or by using the slider bar, system shall change the start and end date of the graphs and tables.

- System shall let the user to display the period for last 365 days.

### 2.1.3. Graphs and Tables

- System shall feed the graphs and tables of the platform by using Yahoo Finance datasets via yahoofinance python library/API.
- System shall provide links to Yahoo Finance and Borsa İstanbul which are used as the main resources of the platform for data sets and information.
- System shall display and change the graphs and tables simultaneously according to the changes executed by the users according to the filtering tools at the sidebar.
- System shall let user to display the graphs in full screen view when users click the expand the graph button.
- While the graphs is in the full screen view, system shall let the user to save the graphs in png and svg formats.
- System shall display the graphs' x axis as in data format and y axis as in price.
- System shall give graphs's line information/definition.
- System shall display the first 5 most increasing/decreasing or highest volume stocks/indicies traded in the Borsa İstanbul according to the filtering selected by users.

### 2.1.4. ML Prediction

- When a user clicks the checkbox button in ML Prediction field, system shall execute a ML algorithm and create a extended data set in the graph for price forecasting according to the prediction results of the ML algorithm.
- The predicted/forecasted/extended data set shall displayed in a different color.
- The first ten rows of the predicted/forecasted/extended data set shall displayed in the table at the main page.
- ML prediction shall be executed by using end of the day closing prices of the stocks or indices.

## 2.2. Scope

One of the most important problems in modern finance is finding effective ways to summarize and visualize financial data to give individuals or institutions useful information about market behavior for investment decisions [19]. In this context, it is aimed to visualize and summarize the financial data with tables and graphs within the scope of the study.

As it is known, technical analysis method is generally used for stock price prediction. However, there are different opinions in the literature about whether technical analysis is efficient or not [10]. With the inadequacy of technical analysis compared to new techniques and the development of data analytics and machine learning techniques, experts in computer science as well as finance experts have started to work on market price prediction models [10, 23]. In this direction, as an another aim of the study, it has been planned to execute ML-based price predictions for stocks and indices.

Although a study is carried out for stocks in the study, this model can be used in other markets and products as traded in the market such as crypto currencies, derivative and debt based products, commodity market product and exchange traded products. While creating the model, basic machine learning methods will be used. Trading signals will be created within the framework of the results obtained from the forecasts.

Platform data will be retrieved via API from yahoo finance. Securities and period can be selected according to different breakdowns with drop down menus and sliders. In addition, the selected securities will be displayed in tables and graphs, sorting and filtering will be possible. In addition, model selection can be made in order to make price forecast. Forecasted values can be displayed on the related securities chart and in the table.

# 3. Design

## 3.1. UML Diagrams

In this section, there are three UML diagrams in order to illustrate the functionality of the platform. These are use case, sequence and class diagrams illustrated in Figures 3.1, 3.2, 3.3.
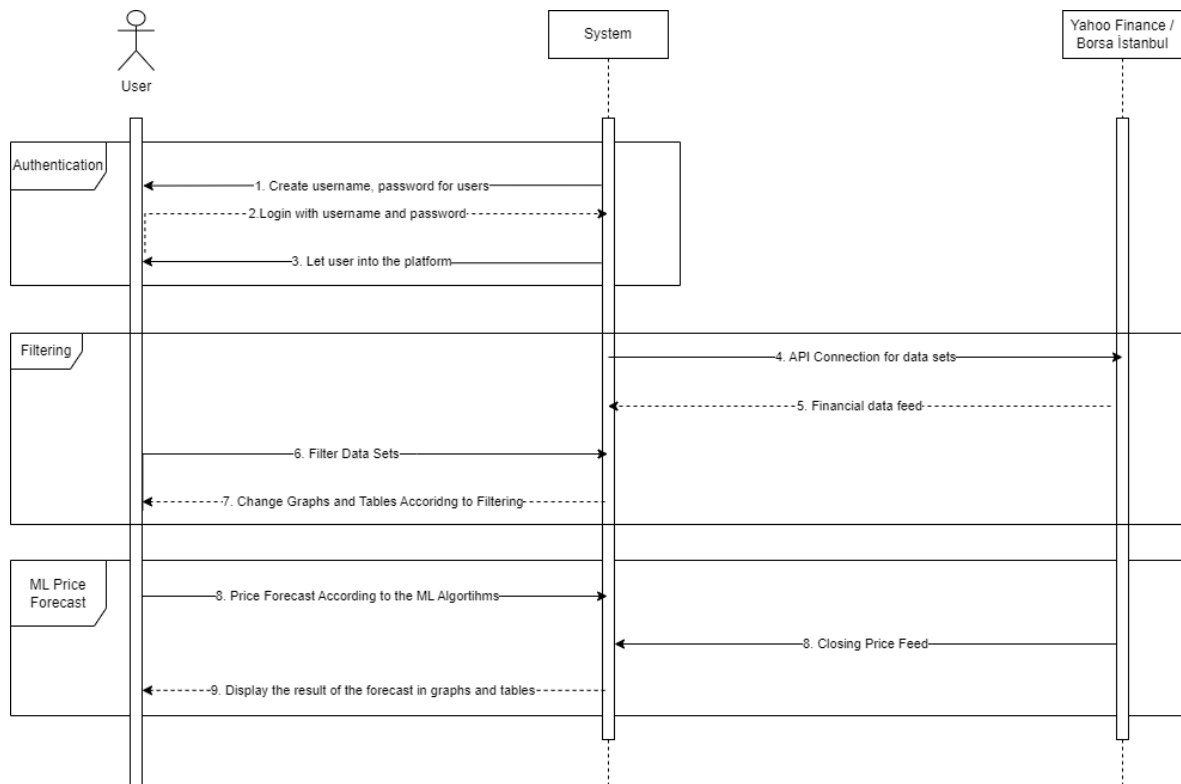


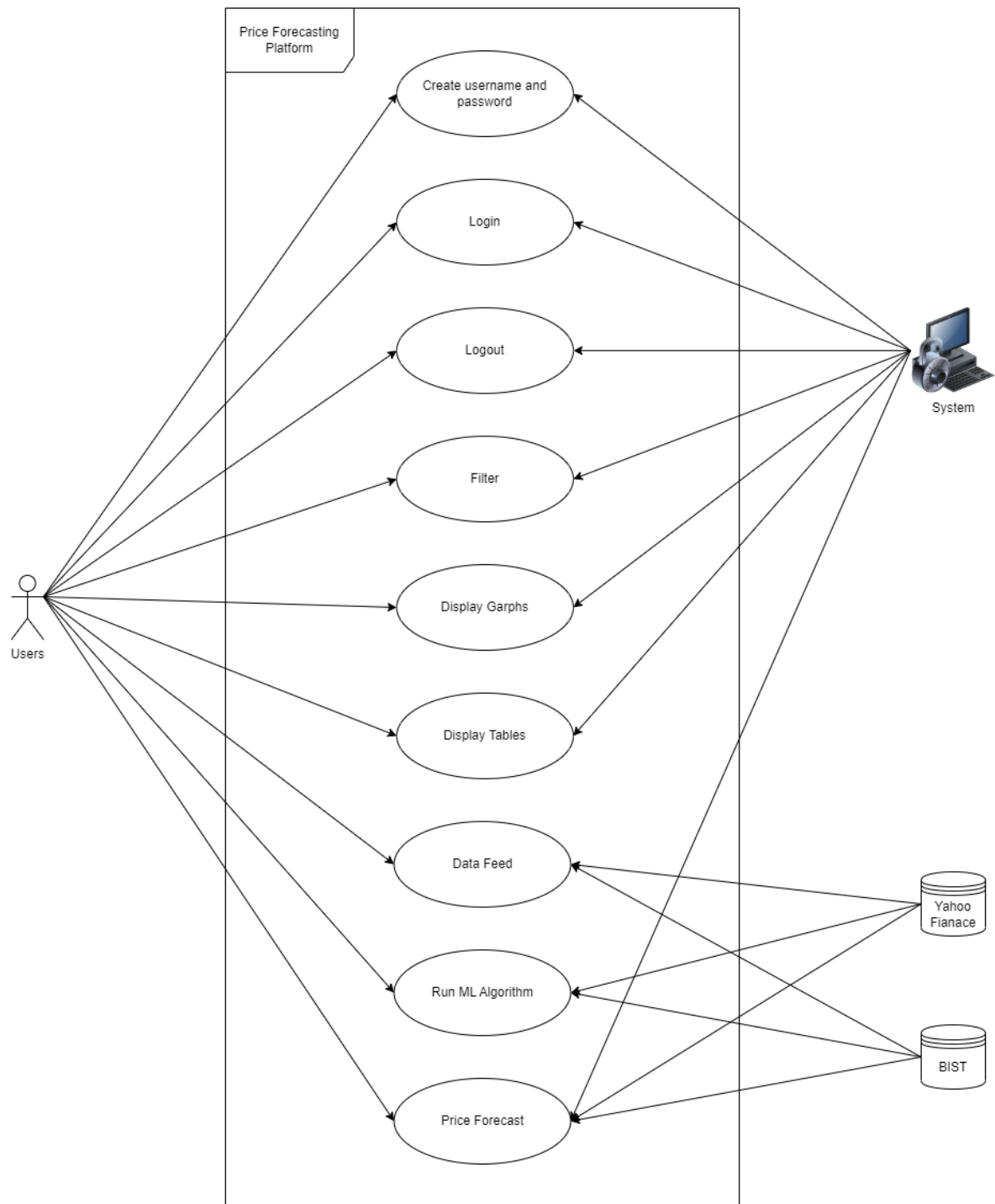Figure 3.1. Sequence Diagram of Financial Price Prediction Platform

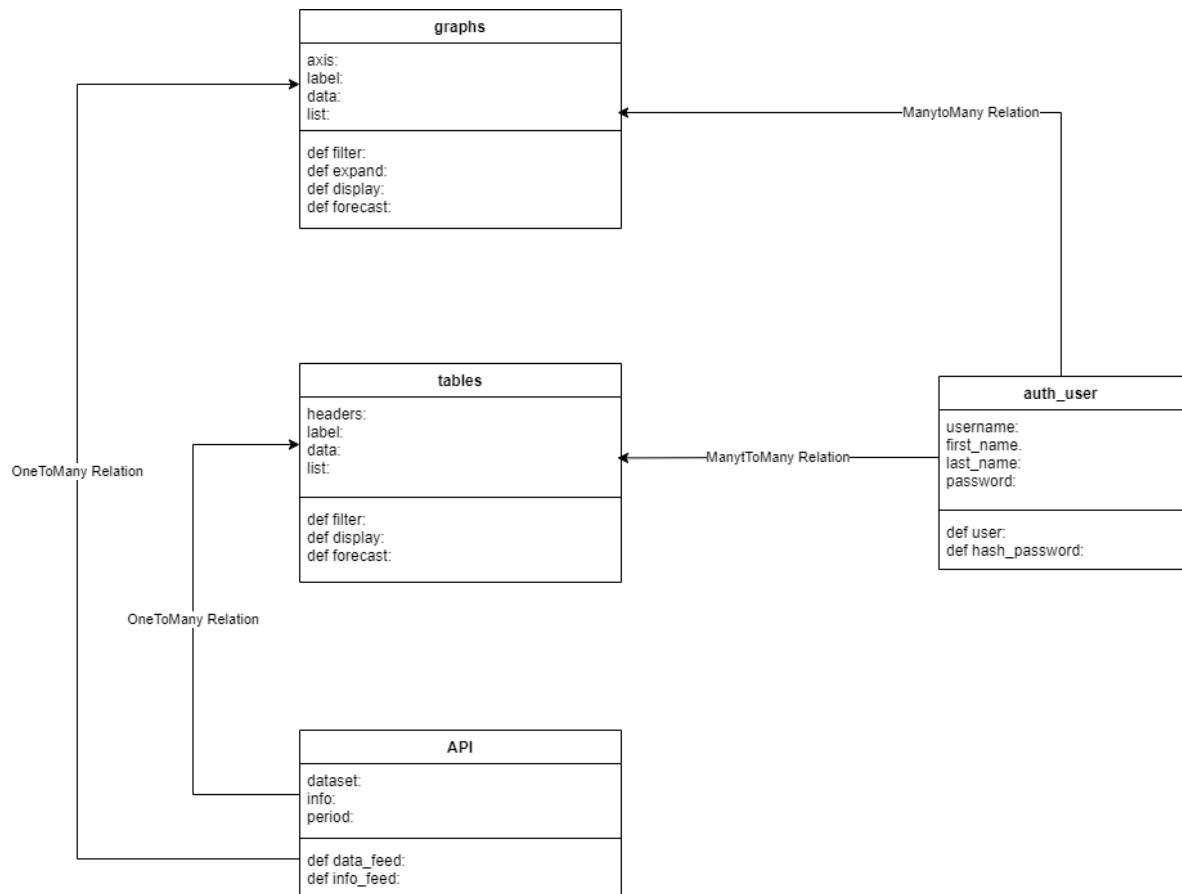Figure 3.2. Use Case Diagram of Financial Price Prediction Platform

Figure 3.3. Class Diagram of Financial Price Prediction Platform

## 3.2. Mock-ups

In this section the UI design of the platform is given by following mock-ups illustrated in Figures 3.4, 3.5,3.6. It may be some little changes/reviews at the end of the project due to the system design needs.



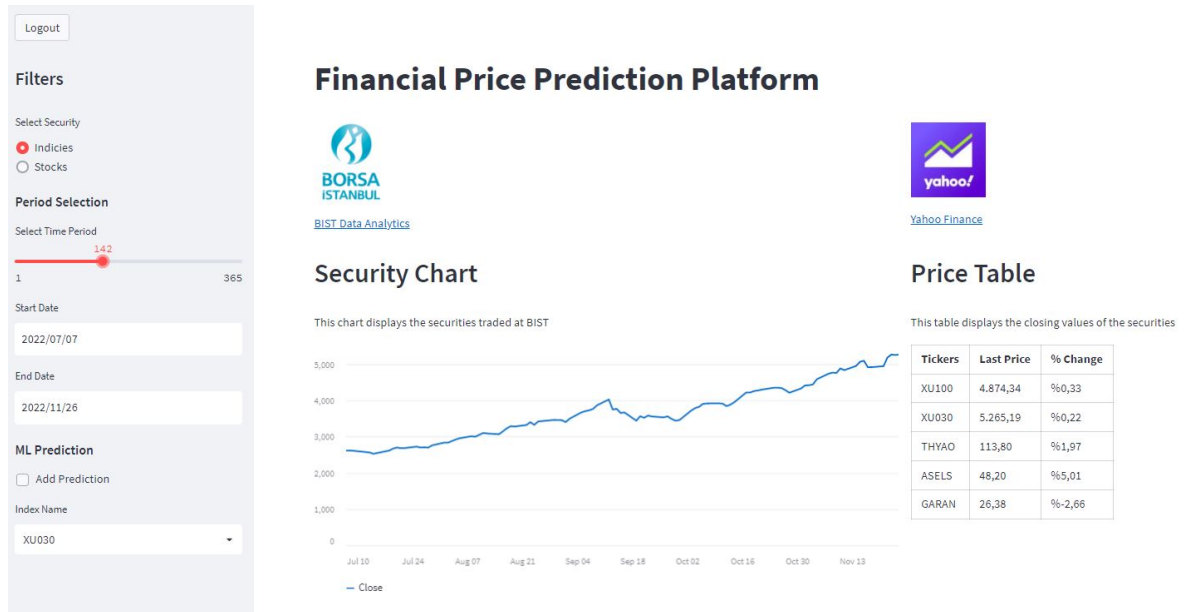Figure 3.4. Login Page View of Financial Price Prediction Platform

Figure 3.5. Main Page View of Financial Price Prediction Platform
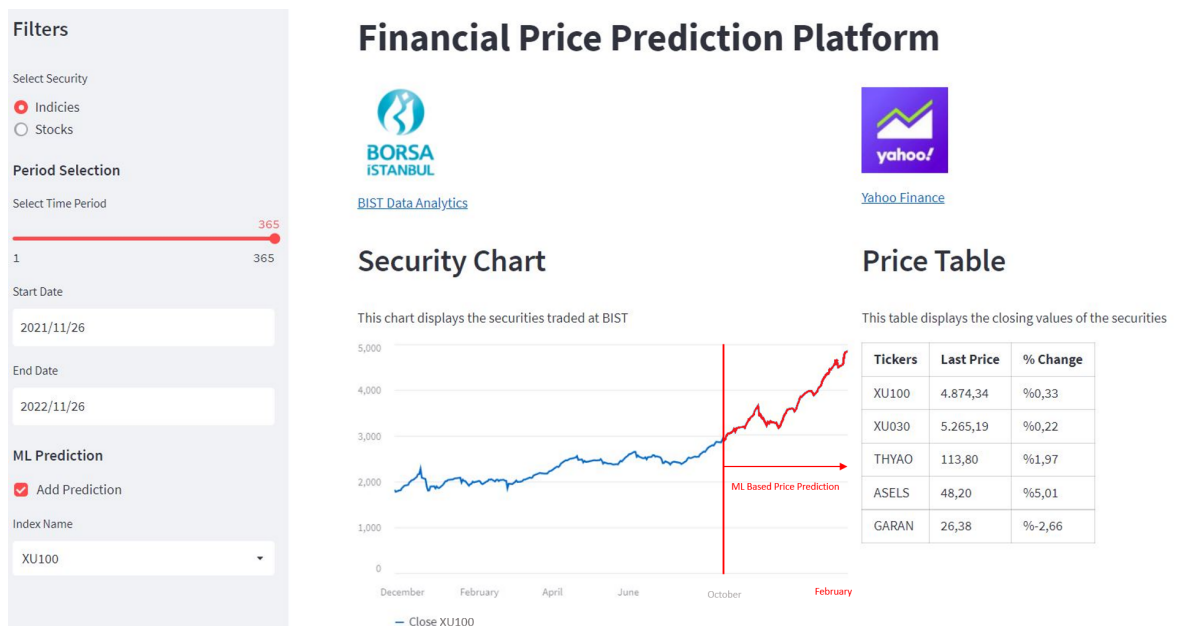


Figure 3.6. ML Prediction View of Financial Price Prediction Platform

# 4.  Implementation

This chapter will be added later.

## 4.1.  Use Case

This section will be added later.

## 4.2.  Demo

This section will be added later.

# 5. Documentation

This chapter will be added later.

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