

Functional Specification

Cryptocurrency Price Predictor

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1. Introduction

1.1 Overview

The product we are designing is the Cryptocurrency Price Prediction web app. Cryptocurrencies have been trending a lot over the last few years and with the rise of decentralised systems, more and more people are beginning to join the cryptocurrency market. We saw this as an opportunity to develop a cryptocurrency price prediction system to allow users to follow the latest trends of Bitcoin as well as some other cryptocurrencies and to specify which cryptocurrency they would like to see predictions for. We aim to design this application in a simple and easy-to-use user interface that will accommodate users who are also new to the crypto space. We are mainly aiming to develop this web app for traders who are in the market and aim to maximise profits based on the indicated price prediction. Considering how volatile the market is, this application is not for financial advice, but rather a way to measure the future trend and provide users with a good indication of when to buy or sell their holdings. This web app will accommodate users to easily navigate between tabs to stay up-to-date with cryptocurrency news and sources while having our app open rather than having to struggle navigating between different apps on a mobile device.

The application shall allow users to select a cryptocurrency to view the price movement on a graph, real-time price changes, percentage change over the last 24 hours, and the volume. Most importantly, users shall be able to view the price prediction of the specified cryptocurrency on a graph and this can be used to indicate whether it is a good time to buy or sell. Users shall also be able to view the news on the current market within the app which will make the app more navigable and accessible rather than having to use a separate news site. We plan to have the application working for Bitcoin first, after which we may add in some more cryptocurrencies and maybe stocks too. This will accommodate users who are in the crypto and stock markets. The application will not allow users to purchase cryptocurrencies. Alternatively, its main purpose is to simply provide users with a guide for the optimal time to buy or sell based on the predictions and the historic price movement on the graph, or do other business transactions outside the application. It is also important that the application shall have various representations of each cryptocurrency (e.g. name, logo, ticker). This shall make it easier for users to understand which cryptocurrency they're looking at as not all users may be familiar with all representations of the cryptocurrency. For example, users who are new to cryptocurrencies may be familiar with Bitcoin, but may not know the ticker for it which is "BTC", etc.

These features shall equip users with ease of use of the application, good accessibility, and a satisfactory experience. Our goal is to make this application as simple and elegant as possible to provide users with the best possible user experience.

1.2 Business Context

The plan for our Cryptocurrency Price Prediction app is to develop it into a web application to accommodate accessibility, ease-of-use, and navigability. This app will be designed for online traders, or even those who are new to crypto, to use the app for their needs. We hope to supply the user with accurate predictions and indicators on when to buy and sell their coins. As cryptocurrency is becoming more popular by the day we think this is a great opportunity for us to produce an efficient app that will fill the user's needs. There are not many apps out there that do what we intend to do so we thought it was a great gap in the market to develop this application.

1.3 Glossary

<u>Term</u>	<u>Definition</u>
Cryptocurrency/Crypto	A digital currency using cryptography that can be used to purchase goods and services
Web App	Application hosted on the web
GUI	Graphical User Interface
UI	User Interface
UX	User Experience
Server	A computer program that maintains access to a network
Machine Learning	Study of computer algorithms which analyses and learns from data
LSTM	Long Short Term Memory is a variety of recurrent neural networks (RNNs) that are capable of learning long-term dependencies

2. General Description

2.1 Product/System Functions

Below are the descriptions of the main functionality we plan to implement for our application. Given this is our first time developing an application with machine learning, there may be some slight changes throughout the development of the web app, and we may decide that certain approaches to the design of the app may or may not work as well as proposed. Nonetheless, our proposed functions are described below. The main functionality will be discussed in further detail in section 3 *“Functional Requirements”*.

2.1.1 Buy/Sell Signals

Users shall be able to easily determine whether it is a good time to enter a position in the market or sell based on the price prediction of the selected cryptocurrency. This can be determined by the price change or the graph which will show the historic, current, and predicted price. For this, we will be using an LSTM method and an Exponential moving average technique. We will also look to incorporate candlesticks into the graph.

2.1.2 Cryptocurrency Selector

A simple dropdown selection tool that shall allow users to select which cryptocurrency they would like to view the technical statistics for.

2.1.3 Technical Graph

Based on the selected cryptocurrency, the price action shall be displayed on the graph of the web app as well as the price predictions. This will aid users to easily identify buy and sell opportunities from a visual perspective via a graph rather than having an exact price prediction value displayed. We plan to have the graph to be incorporated as a candlestick chart which will allow users to determine buy/sell signals.

2.1.4 Calculator

This feature shall allow users to convert between different currencies, for example between Bitcoin and Euro, and vice versa. Also, users will be able to calculate gains/losses based on the predicted price of the cryptocurrency.

2.1.5 Cryptocurrency Statistics

The application will incorporate a feature that will allow users to see the percentage price change over the last 24 hours, as well as the open, high, low, and volume over the last 24 hours. We also plan to have real-time price changes per cryptocurrency to be displayed on the web app. To keep things simple, we will first look to predict the price for a certain time after which we can look to produce custom prediction days, weeks, or months.

2.1.6 Application Modes

We plan to implement 2 modes of the application - a simple/lite mode, and an advanced/pro mode of the application. This will mainly depend on how well we can get the prototype of the app to work after which we can look to incorporate this feature. The purpose of this feature is to accommodate this app for different types of users, ranging from beginners to professional traders.

2.1.7 Crypto News

We hope to incorporate this feature because we want to make this application accessible and easy to use. Having a cryptocurrency news section will provide users with an easy-to-access news source by clicking on the various latest news links provided in our app rather than having to go to another website to search for cryptocurrency news.

2.2 User Characteristics and Objectives

Given this is a cryptocurrency price predictor which revolves around a volatile market, this application is aimed at users starting from ages 18+ and for those who are new or professional in the trading sector. As stated previously, this application is not professional financial advice as users shall do their own research. The users will understand that this application is by no means where you can buy or sell a single asset, but rather serves the purpose of guiding users about the latest and predicted figures in the cryptocurrency market.

The main purpose of this application is for indicating good buy and sell signals via the candlestick charts and the predicted price for the selected cryptocurrency. The other features will also be of use to the users for accessibility and ease of use. The users are assumed to have some familiarity with desktop devices and web applications. Given this is a web application, this saves the user time in having to switch between various apps on their mobile device or switching tabs to access the latest cryptocurrency news and price figures, making it easily accessible. Nonetheless, given what we have learned in CA357 (User Interface Implementation), we aim to provide a seamless, user-friendly UI, and an easy to use application for our users with little or no hands-on experience, including users with accessibility needs.

2.3 Operational Scenarios

2.3.1 User Selects Cryptocurrency

Upon accessing the web app, users will be able to obtain the statistics of the selected cryptocurrency of their choice which the application supports. We aim to have this done via a dropdown selection box for the user to select the cryptocurrency to view the statistics on. They will be able to see the historic price movement, a technical graph, a news section, and a calculator which will allow the user to convert between different currencies as well as calculate the gain/loss based on the prediction.

2.3.2 Selection of Prediction Timeframe

Upon selecting a cryptocurrency to view statistics and predictions with, the users can select a timeframe for the price prediction feature with a slider tool or a pop-up box specifying the time interval of which they want the predictions to be in (e.g within the next day, week, or month, etc).

2.3.3 View Graph

A visual representation of the price movement along with the predicted price movement will be displayed on the graph for the selected cryptocurrency. We plan on having the graph display the historic price movement in daily, monthly and yearly intervals and apply the same for the projected price action. This will give the users a better understanding of the trend in the cryptocurrency price action in a visual format. The graph can be displayed via candlesticks. We will hope to have the graph interactive so the user can use their cursor to pinpoint exact points on the graph.

2.3.4 Reading Buy/Sell Signals

Upon viewing the cryptocurrency statistics and predictions, the user will be able to determine the buy or sell signals based on the predictions as well as based on the patterns of the candlestick chart. The chart will provide a historic and prediction graph with candlesticks.

2.3.5 Calculator

If the user needs to do some calculations, such as converting between currencies, users can use a calculator within the application which will allow the user to convert between fiat and cryptocurrencies as well as calculate the gain/loss based on the prediction.

2.3.6 News Section

As well as being able to read the cryptocurrency statistics, users will have access to the news on the current crypto market. Users can click on the URL of the news title which will redirect them to the original source where they can read more on that specific news. We will include new sources from a number of areas such as online articles and Twitter.

2.4 Constraints

We will also need to make sure the user interface is easy to navigate and follows all techniques that we learned throughout our course work from CASE. We will have to have a trial and error approach with our algorithms for our prediction to make sure we are getting the most accurate outcomes possible.

2.4.1 Internet Constraints

Given that this web application depends on the internet connection, this may be the most important constraint. The news section relies on the internet and therefore the user will need a stable internet connection if they are to make use of this feature.

2.4.2 Time Constraints

This project has a completion due date strictly established by DCU and as a result, we need to make sure all requirements are met and the web app is fully operational by the deadline. Given that we have to deal with other assignments from other modules, we are aiming to have the main functionality implemented after which we can look to expand our application. The management of time will be one of our main priorities throughout this project. As our whole web application is based around prediction, We will need to make sure that we get a fully functioning interface that will display accurate predictions.

2.4.3 Ease of Use

We will ensure that the navigation throughout the web app is made simple and the choice of font, sizes of buttons and text, and colour choices will grant the user a pleasant experience. We will use all techniques that we learned throughout our coursework from CASE.

2.4.4 Hardware Constraints

Given that this is a web application, the application is only supported on desktops and not on mobile devices. Given that we'll be using the LSTM model, the training of the model may take much CPU time and may require GPUs given that running the model is computationally expensive.

3. Functional Requirements

3.1 Search Cryptocurrencies

Description: This feature will allow the user to query for cryptocurrencies in the selection box/dropdown menu. This will be easier than having to manually type the ticker or cryptocurrency name, hence, making the application easier to use and navigable. We will also have a search bar where the user can type in the desired cryptocurrency they would like to look at.

Criticality: This feature is important since, without it, users will not be able to view the cryptocurrency statistics and predictions on the graph. Therefore, if this functionality was not achieved, the application would still serve its objective but will add a layer of difficulty in the usability of the UI.

Technical issues: It is essential that the development of this feature doesn't involve many complications, however, serves its meaning to the user. It is necessary to ensure the accessibility of the dropdown menu, the output of the cryptocurrency, and

the displaying of the corresponding statistics for the selected cryptocurrency. We will run unit tests to ensure all buttons are working correctly on the interface.

Dependencies with other requirements: Since this feature relies on having the user expect the correct statistical output for the selected cryptocurrency, this feature is associated with 3.2 (Cryptocurrency Price Prediction) and 3.3 (Graph Representation). This is because if a cryptocurrency is selected, the application will have to get the selected cryptocurrency's predictions, stats, and chart display of the price movement.

3.2 Cryptocurrency Price Prediction

Description: Being the main feature of the web application, the app will predict the prices for a given timeframe for a given cryptocurrency and display it on a graph for a more visually appealing and easy to understand interface rather than displaying the data in many tables. This will allow for the readability and ease of use of the application.

Criticality: The application may not be of much use without this functionality since it is the main feature of the app. We will have to make sure our predictions output is the most accurate results possible as without accuracy the app is not very desirable.

Technical issues: An issue that may arise is if the user wants to view cryptocurrency statistics and predictions which are not provided in the application. There are thousands of cryptocurrencies in the market, and this would be an intensive exercise to incorporate machine learning forecasting for all cryptocurrencies. New cryptocurrency projects are often launched too, and they would also have to be accommodated in our app. We are aiming to get our application working with the main features for one coin, and then look to add more. If our algorithm is not outputting to the level of accuracy wanted we will have to adjust it and allow the machine learning to relearn the data.

Dependencies with other requirements: In order for this feature to work, users would have to select a cryptocurrency from the dropdown menu. Also, this feature requires a corresponding graph display to allow for the readability of the prediction. Hence, this feature would depend on 3.1 (Search Cryptocurrencies) and 3.3 (Graph Representation).

3.3 Graph Representation

Description: This functionality presents the user with a visual representation of the historic price movement and prediction price for the selected cryptocurrency. If the user wants to specify the timeframe (e.g the prices for the next week), the graph will display the historical price along with the predicted price movement within the next week.

Criticality: It is critical that the prediction is accurate in order for the graph to make sense as we do not want an output that makes the graph unreadable and difficult to understand. We want the graph to display the historical price trend along with the prediction trend. We will try to incorporate a colour scheme of red for down and green

for up. This will allow the user to easily identify the trend of the price over their desired timeframe.

Technical issues: This requirement may seem fairly straightforward to develop, but it will require smooth load times and an appropriate axis in the graph for readability. Since the graph provides a visual representation, we will also provide some extra form of accessibility to describe the graph (e.g. alt text, or other methods) to provide for those with accessibility needs.

Dependencies with other requirements: Given that this feature provides a visual illustration of the historical and predicted price movement of a selected cryptocurrency, it is correlated closely with the UI used for representing the graph.

3.4 Buy/Sell Signals

Description: After the application generates the graph of the historical and predicted price trend, the user will be able to decide on what and where the buy or sell signals are based on the historical price trend and predictions as well as based on the patterns of the candlestick chart. The chart will provide a historic and prediction graph with candlesticks.

Criticality: It is important that the dataset includes the cryptocurrency opening, closing, highest, and lowest price for each day in order for the candlestick charts to display correctly. Without it, users may not determine the buying or selling signals from the historic price movement alone.

Technical issues: Since this web app will make use of a prediction model for determining buying and selling signals as well as viewing historic price data, it's important that the graph is accurate with respect to using the correct axis for readability. Upon hovering over a candlestick with the mouse, we could implement an additional feature such as a small popup beside the mouse summarising the open, close, high, and low values for that candlestick.

Dependencies with other requirements: Since the candlesticks are related to displaying price data on a chart, this feature is associated with 3.3 (Graph Representation). It also relies on the dataset itself with regard to missing values for specific columns. We hope to not run into this problem as we want users to be able to fully read a candlestick chart as a trader would.

3.5 Cryptocurrency Market News

Description: Since this is a web application, we want to make it accessible and easy to use. Having a cryptocurrency market news section will equip users with an easy-to-access news source by clicking on the news links provided in our app and being redirected to the news source so they can read more about it. This will allow for navigability and accessibility since it's better than having to go to another website manually to search for cryptocurrency news, whereas here, it saves time from having to do that.

Criticality: This feature will require the use of a news API, hence, the API is critical to allow for these advances in UI improvements that other similar applications lack. Having a prediction model, historic price movement via a graph, a calculator, and a news section will accommodate users with a satisfactory experience.

Technical issues: Some technical issues with this feature may be that the news API may have a network outage or the servers may go down, hence, not providing the application with up-to-date information. We hope not to encounter such an issue.

Dependencies with other requirements: Since this feature provides users with up-to-date news on the current market, it is closely associated with the UI.

3.6 Currency Converter and Calculator

Description: The application will equip users with a calculator, which will allow them to do some calculations, such as converting between currencies. Users can use a calculator within the application which will allow the user to convert between fiat and cryptocurrencies as well as calculate the gain/loss based on the prediction. This will further make the application accessible and easier to use.

Criticality: It is important the calculator makes the calculations correctly and does not have any significant errors. Any input that the user provides to the calculator shall be passed to the frontend/backend and the result of the calculator sent back to the UI.

Technical issues: As stated before, there are thousands of cryptocurrencies and this feature would be nice to have for all of them in order to quickly make these calculations. However, we are mainly focusing on having the application work for once cryptocurrency after which we will add a few more cryptocurrencies. Nonetheless, this functionality will still be in the app and provide ease of use and accessibilities.

Dependencies with other requirements: This feature will depend on the selected cryptocurrency, hence, it is associated with 3.1 (Search Cryptocurrencies) because the calculations are based on the selected cryptocurrency

3.7 Real-time Price Movement

Description: Real-time price movement of the selected cryptocurrency is a must since traders always look at this type of data. Given the selected cryptocurrency, the real-time price movement will be displayed along with the other features and this will accommodate the application with readability and accessibility.

Criticality: It is important that the real-time price movement will be accurate and is based on the selected cryptocurrency from the dropdown menu. Traders heavily rely on real-time price data especially if they are day traders/short-term traders.

Technical issues: Given the fluctuation of the market, this feature may or may not have some lag with the live price movement. We hope there will not be any lag within our application and that the prices reflect on what is actually shown on the market

Dependencies with other requirements: This feature will depend on the selected cryptocurrency. Therefore, it is associated with 3.1 (Search Cryptocurrencies).

3.8 Testing

Testing is going to be a vital part of the overall project to ensure that we develop a clean functional and secure project. We will be applying the following testing techniques throughout the project.

3.9 Unit Testing

Due to the amount of functionality this app will have, and the amount of buttons that will need to be working, unit testing will be a vital part of our project. Tests will be automated in every aspect of the project. We will be using built-in suites provided by python and javascript in order to enforce our unit testing.

3.10 Integration testing

Following on from this we will be combining units together to form integrations that can be tested independently. This will include the integration between the API and web app, the database and the server. This will help us to eliminate any issues that seem to arise.

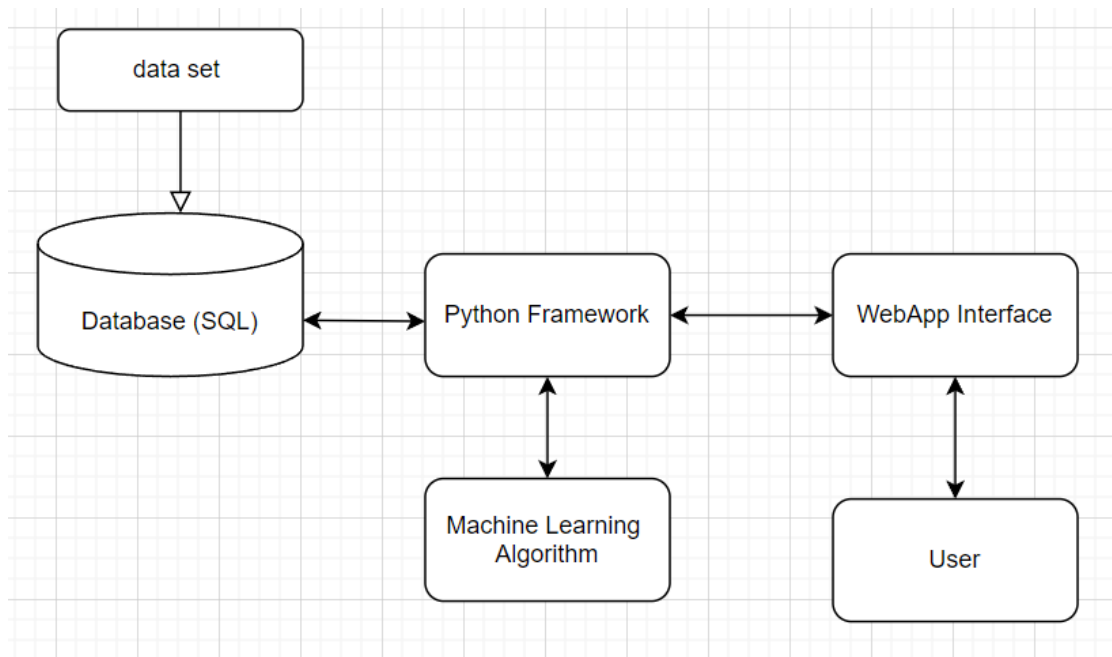
3.11 Interface Testing

As we will have multiple interfaces in this web application, it is important that we apply some UI testing to ensure that the UI is the same and consistent across the whole application. We will be using built-in Javascript testing to make sure the user interface is as user-friendly as possible.

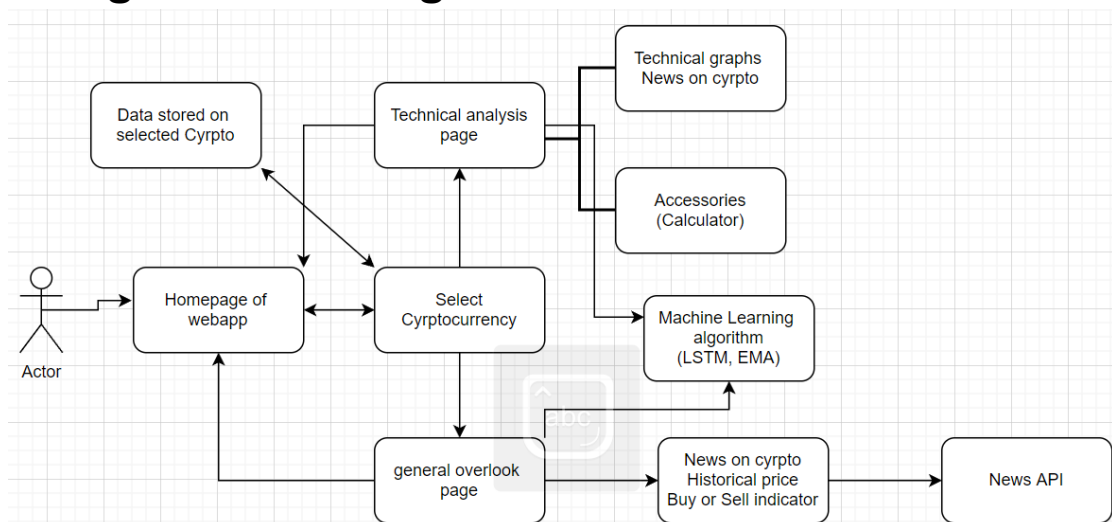
3.12 CryptoRadar

We would like to implement a crypto radar that will indicate to the user which cryptocurrencies are hot and which are not based on real-time data sentiment. We would like this to analyse the most talked about cryptocurrency on Twitter and give you an overview based on the information gathered. This could tell the user if it will be a good idea to buy or not to buy. Also, we would like the crypto radar to display a graph based on whether certain coins are in green for good yellow for moderate or red for negative news about them.

4. System Architecture



5. High-Level Design



6. Preliminary Schedule

6.1 GANTT Chart

Cryptocurrency Price Predictor

