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Project Report

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Mobile Assistant for Cryptocurrency Markets

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Abstract
Cryptocurrencies emerged into our lives because of the blockchain technology. These various coins build up the stock markets for digital currencies. As a result, people start to invest into these coins to make profit. Different stock markets entered to the field of trading. This investment in crypto coins got more popular as time passes. The goal of our project is to develop a mobile application to assist users to track about their favourite crypto coins, track about the stock markets and find the best path to profit. To do so, this application suggests best coins to invest in by giving the user details (prices, fees etc.) about crypto coins fetched from various cryptocurrency markets.

Key words:

Android development, Cryptocurrencies, Stock Market

Özet:

Blockchain teknolojisinin hayatımıza girmesiyle beraber kripto para birimleri ortaya çıktı. Birçok farklı kripto paralar farklı dijital borsaların çıkmasına sebep oldu. Bunun sonucunda insanlar bu kripto paralara yatırım yapmaya ve kâr yapmak için çalışmaya başladı. Farklı borsalar girdikçe ve zaman geçtikçe bu yatırım ağı gitgide popülerleşti. Projemizin amacı bir mobil uygulama geliştirmek ve bu uygulama kullanıcılara favori kripto paralarını, favori borsalarını ve en kârlı yolu göstermektir. Bunu yatırım için en iyi kripto paraları göstererek yapacaktır. Kripto paraların ve borsaların o anki durumunu kullanıcıya gösterecektir.

Anahtar Kelimeler:

Android Geliştirme, Kripto Para Birimleri, Borsa

1. Introduction

1.1. Problem Statement

Cryptocurrencies' values are changing often as people buy or sell crypto coins. Also, new markets and coins are entering regularly. This is difficult to track and therefore, it is difficult to invest. This project help users by providing the momentary values of the crypto coins from various crypto markets. This will help users for investing. Also, our project will have an assistant to find best path for profiting. This assistant will help users to see the most profitable exchange route. Even the newcomers to the trading world will understand very easily.

1.2. Related Work

There are some applications related with cryptocurrency tracking. Most popular one is called "Blockfolio". This application can compare many coins and track different markets. This project is mentioned in our literature review [24]. But, our application will have an extra assistant section that will show users to most profitable exchange route with the help of input and output coins selected by user.

1.3. Solution Statement

Project aims to develop on React Native and NodeJS. We will build the front-end with React Native and back-end with NodeJS. This application will give insights about crypto coins, gives valuable information to who has interest in cryptocurrencies.

Our application helps users to track different cryptocurrencies from various markets. This will assist investors to have them realize what is the current situation of specific coin. Application will give various information about specific coin. For example, application will show coin's volume, concurrent value, 24-hour lowest value, 24-hour highest value, markets which supports that coin and optionally, you can change time interval to see more information.

One of the main features of the project is assistant. Assistant will work when the user selects input currency, output currency and desired markets to analyse. After selection, user will tap "Find Possible Chains" button to see the most profitable exchange paths. Crypto coins' values change quickly so, best chains may be change rapidly.

1.4. Contribution

There are some applications will work like ours but, our application's "Assistant" extends technology with artificial intelligence. It will show users to most profitable pathway after user enters necessary inputs.

2. Literature Search

2.1. Introduction

Since blockchain technology evolved, people started to realize that crypto coins can be very profitable, and a ton of crypto coins are entered the scene of trading markets. As a result, more people started to invest in various crypto coins like Bitcoin, Ethereum, Ripple etc. This huge interest in crypto coins brought different markets for crypto coins. Since mobile applications got popular, people use mobile applications for nearly everything because of their practicality. As the scene of crypto coin trading gains more population, software companies discovered that there is a need of easy-to-use mobile applications for crypto coins, to compare prices and track detailed information from different cryptocurrency markets and developed different applications with features such as price comparing and tracking past prices of a crypto coins.

While people who are interested in economics can analyse values in graphs and numbers, others still search for “invest opportunities” that they can rely on to profit. In our project, the main feature is to analyse different crypto coin market data and assist the investors to find the best investment route which is the most profitable one among crypto coin markets for trading cryptocurrencies. This paper has information about crypto coins in general, how cryptocurrency markets introduced, cryptocurrency exchange(trading) and previous works about how artificial intelligence used for analysing stock prices in real money exchange markets.

2.2. Blockchain

In 2008, Blockchain was invented by Satoshi Nakamoto. It created to serve as the public transaction ledger of the cryptocurrency bitcoin [1]. The design of Bitcoin has inspired other applications. In addition, blockchains which are readable by the public are used by cryptocurrencies.

The validity of the coins of each crypto currency is provided by a blockchain. A blockchain is a continuously growing list of records called blocks. Blocks are secured by using a cryptography and blockchain [1]. Each block usually contains a hash pointer as a link to the previous block, timestamp, and process data. Once saved, the data in any block cannot be changed retrospectively. Blockchains are safe with design.

2.3. Cryptocurrency

The cryptocurrency or crypto currency is designed to work as a medium of exchange that uses cryptography to secure financial transactions, control the creation of additional units, and verify the transfer of assets. Cryptocurrency is a digital entity [2]. Cryptocurrencies are alternative of currency and digital currency. It is also a subset of the virtual currency. Cryptocurrencies use decentralized control. The centralized digital currency and central banking systems are separated from cryptocurrency in this aspect.

2.3.1. Types of cryptocurrency

Every cryptocurrency's decentralized control works through the blockchain. In 2009, Bitcoin, created and it was the first decentralized cryptocurrency. Then, many other cryptocurrencies were created. They are often referred to as altcoins [2].

Decentralized cryptocurrencies such as Bitcoin and other altcoins [3] have affected the people's attention and interest. Many people would call this the rise of technological revolution, and the "wave of the future" [4]. Emerging altcoins like Ethereum and Counterparty expand Bitcoin by offering useful programming language for writing smart contracts. They are user-defined programs that defines rules governing transactions, and that are enforced by a network of peers**.**

2.3.1.1. Altcoin

Altcoin has various but similar definitions. Stephanie Yang from the Wall Street Journal described altcoins as "alternative digital currencies" [5]. Also, Paul Vigna from the Wall Street Journal described altcoins as alternative versions of bitcoin [5]. Aaron Hankins of MarketWatch defined to any cryptocurrencies other than bitcoins as altcoins [5].

As of 19 August 2018, the number of cryptocurrencies existing over 1600 and it is increasing [4]. We've become able to create a new crypto currency at any time [2]. With market capitalization, Bitcoin is now the largest block chain network, then Ethereum, Bitcoin Cash, Ripple, Litecoin and EOS [6].

2.3.1.2. Bitcoin

In 2009, Bitcoin was offered as open source software. In general, it is considered first distributed cryptocurrency. Since the Bitcoin, more than 4,000 altcoins have been created. When Satoshi Nakamoto mobilized the Bitcoin block chain for the first time, he was simultaneously bringing two radical concepts, and they had not been untested before. Bitcoin, a decentralized peer-to-peer online currency. He gathered public attention in terms of both the political aspects of a currency that was not a central bank and extreme up and down volatility in price [7].

Bitcoin is a decentralized currency that uses peer-to-peer technology to collectively perform all functions such as currency issuance, validation, and transaction processing by the network. Bitcoins are digitally generated by complex algorithms of powerful computers and by a mining process.

2.3.1.3. Ethereum

Ethereum blockchain shows similarity with Bitcoin blockchain. While many Bitcoins and Ethereum are examples of cryptocurrency, there are subtle differences about what they can be used for and how they work. Ethereum is a public, blockchain based, open source distributed computing platform and smart contract functionality [4].

2.3.1.4. Litecoin

Litecoin is different from Bitcoin. The Litecoin Network goals to execute a block every 2.5 minutes. This number is 10 in Bitcoin. Developers think that this give Litecoin has a faster transaction confirmation [8].

Litecoin use the Scrypt algorithm, FPGA and ASIC devices produced for mining Litecoin are more expensive and more complex to produce than for Bitcoin using SHA-256 [9].

2.4. Cryptocurrency Mining

Cryptocurrency mining or cryptography. Cryptocurrency mining is a process in which transactions for various forms of cryptocurrency are verified and the blockchain is added to the digital ledger. Cryptocurrency mining, Bitcoin mining or altcoin mining has increased both as an activity and topic in the last few years. A cryptocurrency miner is responsible for ensuring the reliability of information and updating the block chain with the process. The mining process itself involves competing with other cryptomes to solve complex mathematical problems with cryptographic hash functions associated with a block that contains transaction data.

2.5. Cryptocurrency Wallet

A crypto currency wallet can be used to receive or spend the crypto currency and stores it in the public and private "keys" or "addresses". It is possible to write with a private key in the public ledger if we want to spend the associated cryptocurrency effectively. It is possible to send currency to others' wallets with the public key [10].

A cryptocurrency wallet is a software program that interacts with various blockchains, so users can watch their balances, send money and do other things. If you want to use a Bitcoin or other cryptocurrency, you need to get a digital wallet. All these are the records of the processes stored in the blockchain.

Coins are transferred to your wallet's address when a person sends you bitcoin or another digital currency. To spend this money and open funds, private key stored in wallet must then match the public address to which the currency is assigned. If the public and private keys match, the balance in your digital wallet increases. In addition, the senders will be reduced accordingly. There is no real exchange of real money [10]. The operation is a transaction record in the block chain, which is expressed by the change in the balance in your wallet with cryptocurrency.

2.6. Cryptocurrency Markets

With the emerge of the crypto coins like Bitcoin, new type of currency has been entered to the market. More than 500 cryptocurrencies are traded in several markets. Most popular one among them is Bitcoin and it has the largest market cap above all cryptocurrencies. According to the stats at year 2015, Bitcoin’s value is $291 per unit and has a market cap of $4.05 billion. Bitcoin is followed by some other coins like Ethereum and Ripple. For the other cryptocurrencies which they called “altcoins”, had a market cap about $619 million (2015). In recent years, altcoins are gaining value quickly, more than Bitcoin itself. At year 2013, Bitcoin had a market cap about $1.2 billion. At that time, Bitcoin was covered all the cryptocurrency market by 95%, with the

help of blockchain and data mining, new altcoins started to show up and market cap percentage of Bitcoin started to decrease [11].

A coin called Auroracoin is introduced. This cryptocurrency is a technically modified version of Litecoin and it is official crypto coin of Iceland. Auroracoin had reached market cap of 500 million USD at some point [12].

Various cryptocurrencies are entered the market, and this arises a competition between crypto coins. Crypto coins are not only a currency, it is also having a financial aspect. According to the article "Competition in the Currency Markets" cryptocurrencies involve roles in market with multiple effects [13,14].

One of the effects is called reinforcement effect. This means that, if specific cryptocurrency is becoming famous, then more investors will have faith in it. This results that, that specific cryptocurrency is gaining more reputation among other cryptocurrencies. Another effect is called substitution effect. Investors invest in other cryptocurrencies because people fear the volatility of a popular crypto coin like Bitcoin [13,14].

By the date 05 November 2018, according to the coinmarketcap.com, Bitcoin has the most market capitalization among other cryptocurrencies with percentage of 31.01%. Below there is a figure.

1. Bitcoin (31.01%)

#	Source	Pair	Volume (24h)	Price	Volume (%)
1	CoinBene	BTC/USDT	$150,814,215	$6445.50	3.49%
2	DOBI trade	EOS/BTC	$125,415,806	$6451.64	2.90%
3	OKEx	BTC/USDT	$122,128,354	$6444.09	2.83%
4	DOBI trade	ETH/BTC	$114,739,423	* $6446.35	2.65%
5	Huobi	BTC/USDT	$111,738,795	$6445.67	2.59%
6	IDAX	BTC/USDT	$108,553,492	$6445.66	2.51%
7	Binance	BCC/BTC	$105,018,575	$6433.59	2.43%
8	CoinsBank	BTC/EUR	$74,584,095	$6406.89	1.73%
9	Binance	BTC/USDT	$67,146,292	$6443.21	1.55%
10	ZB.COM	BTC/USDT	$64,950,292	$6443.04	1.50%
		View More			
Total/Avg			**$4,321,839,695**	**$6441.40**	

Figure 1 – Volume of Bitcoin from coinmarketcap.com (05.11.2018)

2.7. Cryptocurrency Exchange

There is a huge cryptocurrency exchange called Cryptsy opened on May 20, 2013 and closed in January 2016. Over 230,000 users had registered to this exchange. At the last recorded day in Cryptsy, its trading volume was 106,950 USD, which have an accolade of tenth biggest cryptocurrency exchange in trade volume. At that time, Cryptsy had 541 trading pairs i.e. Bitcoin, Ripple, Litecoin. These stats make Cryptsy the third greatest exchange according to its

size in the market. Cryptsy become famous as more and more different altcoins are available for the trade [12].

At early stage, there is a consideration about the trading of cryptocurrencies like Bitcoin directed to speculative trading [16,17]. Speculative trading movements like investing without any rational ideas has a crucial aspect of digital currency exchanges. Volatility of the market drives people to trade speculatively [15].

The importance of decent currency exchange is crucial for cryptocurrency trading among digital currencies. The exchange market of digital currencies has grown fast over time. It is understandable that, this growth is not yet to end. Mt. Gox was one of the popular exchange until mid-2013. At that time, FBI closed an account belongs to Mt. Gox which includes about $2.9 million. This operation drained the exchange, which means that, it is now difficult to access by U.S customers. In February 2014, Mt. Gox has a security breach and there was a big loss of Bitcoins. At late 2013, the biggest Bitcoin exchange is BTC China with 35% of all the trades. For trades between USD and BTC, in early 2014, there were three big exchanges: BTC-e, Bitstamp and Bitfinex. BTC-e is the first one and has a volume about %25. Bitstamp is only trades BTC/USD and has a volume about 50% in the currency pair. Bitfinex is a later exchange and has a 25% of the exchange market [14].

Bitcoin's value can be considered as its exchange rate comparing to other digital currencies. Most users of Bitcoin do not interest in data mining. They are buying Bitcoins from other users with their "local currencies". Exchange across different exchanges has its own ecology. This trading results in connecting Bitcoin and real economy [15].

After the accident at Mt. Gox, many altcoins appeared out of nowhere. This results in more and more cryptocurrency exchanges entered in the market. The competition between cryptocurrencies is getting bigger and bigger as well as currency exchanges got much more bitter. Different from USD, only global currency is Chinese Yuan in the cryptocurrency exchange market. There are two major cryptocurrency exchanges between BTC/CNY, BTCChina and OKCoin. BTCChina works only with Chinese Yuan while OKCoin allows both Chinese Yuan and USD. Also, BTC/EUR exchange is considered as well. However, Euro does not have a role as big as USD and CNY but, there is still has a remarkable percentage of trade. The biggest exchange which allows Euro as a currency is Kraken. Kraken has a volume about 3.3% [13].

Cryptocurrency Exchanges / Markets List

Indexing 211 Cryptocoin Exchanges with a total 24h Volume of $5.35B on 7243 trading pairs!

Rank	Exchange Name	Markets	24h Trades	24h Volume	Marketshare
1	Binance	291	>2,790,132	$793,694,318	28%
2	Huobi	196	>1,664,897	$321,576,326	11%
3	HitBTC	379	>339,318	$224,549,193	8%
4	Bitfinex	165	>214,360	$211,059,425	7%
5	ZB.COM	75	>612,157	$164,416,424	6%
6	LBank	39	>123,110	$162,740,794	6%
7	upBit	264	>326,415	$155,849,347	6%
8	IDAX	34	>263,750	$96,372,530	3%
9	DigiFinex	6	>248,244	$90,117,249	3%
10	Kraken	70	>115,669	$83,077,665	3%

Figure 2 – Most popular cryptocurrency markets from cryptocoincharts.info (05.11.2018)

The price of same cryptocurrency can differ in different exchanges. This results in some trading opportunities between exchanges. There are some tests for these opportunities, which monitors potential trades concerning USD/BTC and compare the exchange rate between USD and BTC on different exchanges i.e. Bitstamp, BTC-e. After these tests, whole data shows that trades across exchanges are more profitable than trades within exchange [13,14].

2.8. Using AI Algorithms to Foresee Changes in Trading

There are a lot of researches about using artificial intelligence algorithms in terms of forecasting changes of a stock price. Most of the researches have indicated that using ANNs (artificial neural networks) are unable to detect prior patterns, primarily because of that changes in stock prices don't have meaningful patterns. Besides the complexity of alterations in stock prices, also there are strong chance that the obtained data can have huge noise which complicates the process of determining appropriate patterns [18].

2.8.1. Algorithms Used for Guessing Stock Market Prices

In first studies about using artificial intelligence algorithms, Kimoto et al. have intended to predict the most profitable time for selling or buying a stock with help of the modular neural networking. These neural networks are supposed to be able to understand the relationship between patterns in economical indexes and operations done prior to buying and selling [19].

Artificial neural networks are based on human brain structure. Neurons in brain work as a transmitter – they take signals as input and fire signals as output. This indicates that neurons' outputs will be based on inputs they've taken [20]. Recurrent neural network is a model that consists of three different layers named as input layer, hidden layer and output layer. Input layer takes observed data whereas hidden layer scales the input data and fires the output layer the scaled data. Finally, output layer divides the data by their likeliness and clusters them [21].

Later, Hassan and Nath developed a new approach using a finite state machine named as Hidden Markov Model to analyse stock prices of some airline companies. The reason behind their

choice using Hidden Markov Model is told by them as this model is good at continuous data flow and strong in terms of foreseeing similar patterns. They used a stock's highest and lowest value with daily opening and closing values as inputs to predict the next day's closing price [22].

Kim and Han proposed a hybrid model of genetic algorithms and artificial neural networks to detect patterns in stock prices. Their approach suggests that combining genetic algorithms with ANN can help to find patterns in a noise prone dataset such as stock prices. The reasoning behind that is ANNs are not well-fit to process datasets with huge noise besides being swift while classifying the data. Using generic algorithms help ANNs for processing of these data in a good way since genetic algorithms can discrete big amounts of continuous data, which is a weakness of ANN algorithms [18].

2.9. Previous Work Done About Market Mobile Apps

While smart mobile device technology is evolving, they are also getting a strong place in people's lives day by day. Being so, using these devices' advancing computational power to create powerful tools for almost everything is inevitable.

In earlier days, Kargupta et al. [23] studied about creating a mobile application called MobiMine to monitor stock markets for PDAs (Personal Data Assistants) which is one of the earlier versions of smart mobile devices. Their purpose is to keep data relevant to stocks, manage portfolios, and monitor specified stock markets. Besides Kargupta et. al. had no intentions to predict a stock's price, they still utilized some data computing algorithms such as clustering and Bayesian networks for promised features above.

Later, with introduction of cryptocurrencies, mobile applications for cryptocurrencies are also introduced. One of the featured mobile application is called Blockfolio. Blockfolio [24] is a cryptocurrency portfolio application that utilizes mainly coin trading. By using this application, users can track more than 80 cryptocurrencies, and read latest information about them. Also, it utilizes order books using APIs from several coin markets to give user an insight. It also visualizes the data with graphs for easier tracking and comparing to help users analyse their profit and loss. Being a cryptocurrency tracking application, users can also track several global currencies such as USD, EUR and so on. Like MobiMine, this application is also yet to assist users about what to buy or sell.

3. Software Requirement Specification

3.1. Introduction

3.1.1. Purpose

The purpose of this document is to describe Mobile Assistant for Cryptocurrency Markets application. This application is intended to help cryptocurrency enthusiasts to access order books of cryptocurrency stock markets, give insights with comparisons by visualizing specific cryptocurrency data, and help users to find the most profitable exchange among cryptocurrencies and stock markets by analysing various stock markets' prices for currencies and fee policies of markets. This document defines this product's details by covering requirement specifications, user characteristics, selected methodology for development, and interfaces. Also, this document defines system constraints and concerns of stakeholders.

3.1.2. Scope

With the interest to cryptocurrencies growing day by day, more people started to ponder about how to make significant profit by trading those virtual currencies using stock market websites which are being used to buy/sell cryptocurrencies, like how people trade foreign exchange using real money. Unlike the people who knows "tricks" and methodologies to profit using those currencies, there are still a lot of people who are interested in trading, but don't know what to do and which to learn for earning money.

This application's main concern is to help people who have the desire to track down and trade cryptocurrencies. Using stock markets' API modules, the assistant can compare prices and amount of fees deducted from the user among various stock markets to show users the best pathway to follow for profiting. This application also aims to find the most profitable exchange chain between stock markets. For example, if there isn't a possible direct exchange (a coin is not supported by market) between two cryptocurrencies in a specific market, the application can suggest a trading path which includes more than one market.

Using the assistant, users can find their favourite trading market by checking and comparing order books and fee policies of stock markets and gain an insight of their favourite crypto coins by reviewing price history of them.

3.1.3. Glossary

TERMS	DEFINITONS
API	API is an interface that utilizes communication between two clients [25].
Cryptocurrency	Blocks of cryptographic digital information that designed to replace normal currencies [26].
Stock Market	Stock markets are places where people can buy/sell in a collection of exchanges [27].
Android	Android is a mobile operating system which is based on a derived Linux kernel [28].
GUI	The main user interface module consists of graphical icons and indicators [29].

Table 1 – Glossary of SRS

3.1.4. Overview

Below this section in the first part, the document includes a perspective of the product, user characteristics and suited development methodology in terms of specifications of product. In the second part, functional and non-functional requirements analysis, use cases, interfaces and system attributes are included.

3.2. Overall Description

3.2.1. Product Perspective

Cryptocurrency works independently of the banking system. It can be used like cash in many countries. The application evaluates crypto coin and analyses it according to many criteria. In the light of the information provided by this system, users can easily find the way to sell or buy goods or services and system gives users an advantage over this aspect. In this application, we develop a mobile assist for cryptocurrency market that can be easily used by users.

3.2.2. Product Functions

This system is a simple and powerful cryptocurrency portfolio application, in which you can track bitcoin and many altcoin market prices. Users do not have any registration process. It has an easy view to see your cryptocurrency investments on the Android platform and to have more details. Using stock markets' API modules, we can check latest status of stock markets and currencies. We expect users to encounter a stock market list at first. Users select a market from the market list and according to this, the application gives a list under the name of the currency list. This list has an up-to-date price list that can be easily seen, and the list can be sorted according to the market value of the currency. It also includes the information section of the market they choose. Features such as current and past pricing, fee prices, volume and exchange info are available. The user has an option under the time-range name to see the performance of the currency in different time periods. In short, the system can help users determine the trend direction and see what the current market situation

3.2.3. Development Methodology

We plan to use Scrum when developing this project. Scrum is an administrative model with very simple rules. It is implemented for the management of complex software projects that are open to change. Scrum does not specify the steps to be followed in detail in the project and instead offers a flexible management with a few simple but important rules. Scrum includes daily meetings and project process are divided into sprints. The most important advantage is the short sprints and dealing with the changes thanks to the feedbacks in an efficient way.

3.2.4. Operating Environment

The software of the product will be designed for the Android platform. It can work on any phone with Android operating system.

3.2.5. User characteristics

3.2.5.1. General User

3.2.5.1.1. The user must read and understand the English language as the application is English-based.

3.2.5.1.2. The user is expected to use the Market Application.

3.2.5.1.3. The user is expected to use the system to obtain and analyse information.

3.3. Requirement Specification

3.3.1. External Interface Requirements

3.3.1.1. User Interfaces

The application will be running on Android platform. Besides the main menu, this program also will have several GUI structures for some of the features like when listing markets/coins, showing best path and searching.

3.3.1.2. Hardware Interfaces

There will be no need for implementing any hardware interfaces for this product.

3.3.1.3. Software Interfaces

The application will work on Android, hence there will be no need for any additional software interfaces besides the operating system.

3.3.1.4. Communication Interfaces

Because the data will be pulled from the APIs, a stable internet connection will be required.

3.3.2. Functional Requirements

3.3.2.1. List Markets Use Case

- Show a list of markets
- Sort markets
- Select a stock market
- Show detailed information of selected market (fee policy etc.)
- Show tradable coins in selected market

Brief Description

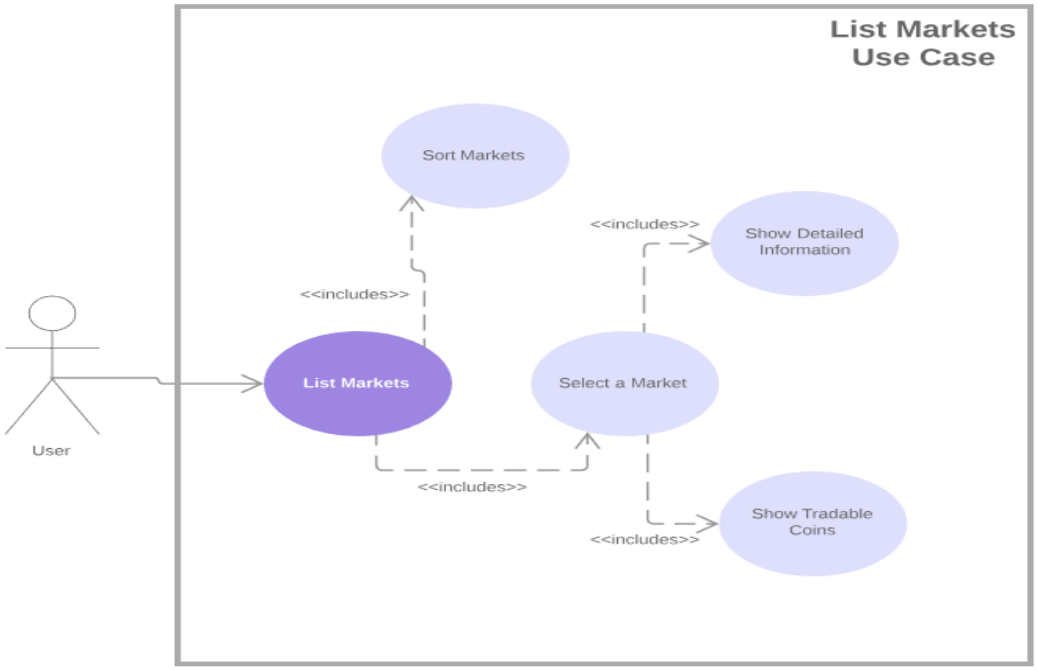

Figure 3 – List Markets Use Case Diagram

Figure 1 shows the use case diagram that a user can perform during market listing. The user can bring a list of markets and sort them according to the attributes of markets. User can select a stock market in the list if he/she desires to see detailed information such as fee policies, volume etc. Also, user can see which coins are supported by these markets.

Initial Step by Step Description

1. User shall see a list of stock markets to choose.

2. User shall sort markets by their attributes (name, volume, fee price etc.).

3. User shall select a stock market for details.

   3.1. User can see selected stock market's policies and transaction volume.

   3.2. User can see cryptocurrencies supported in the selected stock market.

3.3.2.2. List Coins Use Case

- Show a list of coins
- Sort coins
- Select a coin
- Show stock markets that support selected coin and price in that market
- Show price history between specified time interval

Brief Description

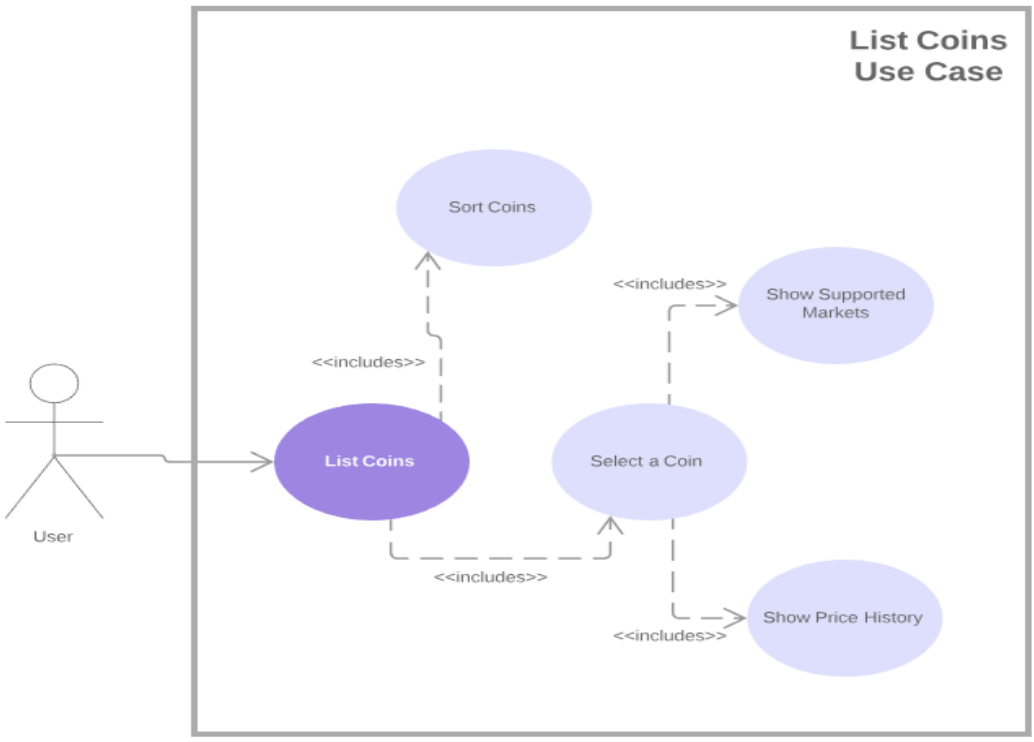

Figure 4 – List Coins Use Case Diagram

Figure 2 above shows the use case diagram that a user can perform during coin listing. User can call for a list of coins. Those coins can be sorted by their prices, volumes and change of value in percentage. If a user taps on a coin, he/she can see stock markets that support selected coin. Moreover, the user can inspect price history of that coin in a stock market.

Initial Step by Step Description

1. User shall see a list of crypto coins.

2. User shall sort crypto coins by their attributes (name, price, volume, daily change etc.).

3. User shall select a desired coin for details.
   3.1. User can see a list of markets that support selected crypto coin with prices sorted.
   3.2. User can see a price history of selected coin in a market.

3.3.2.3. Find Best Path to Profit Use Case

- Select input and output coin/currency
- Select markets desired for exchanging
- Show best path according to selections with instructions and pricing

Brief Description

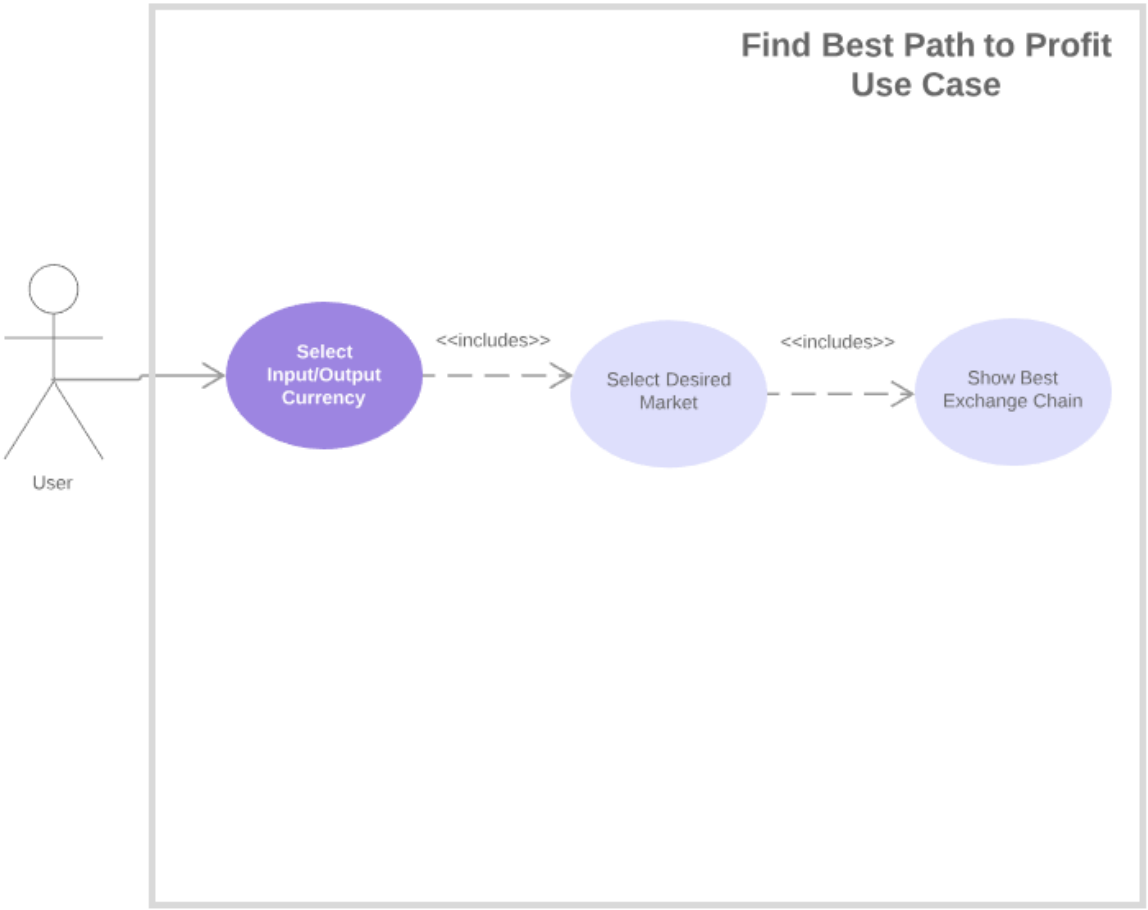

Figure 5 – Find Best Path to Profit Use Case Diagram

Figure 3 shows the use case diagram that a user can perform during best profitable chain finding. User can select an input and an output coin or currency to be exchanged. Then user can select desired stock markets to exchange these inputs and outputs. Finally, a pathway for best exchange will be shown to the user according to his/her selections.

Initial Step by Step Description

1. User shall select an input and output coin or fiat currency to be exchanged.

2. User shall select one or multiple stock markets to allow exchanging of input and output coins or currencies.
3. User shall be prompted with possible exchange route according to the selections that user made earlier.

3.3.3. Performance Requirements

Our product runs on Android Environment; therefore, minimum system requirements are as follows:

1) CPU: 1.4 GHz – Quad Core or above

2) RAM: 2 GB or more

3)Operating System: Android 6.0 (Marshmallow) or above

4) Stable Internet Connection

3.3.4. Software System Attributes

3.4.1. Portability

- The product works with Android devices, therefore any device that uses Android version 6.0 or above and satisfies the performance requirements will be suitable.

3.4.2. Performance

- Performance can be changed due to the internet connection at that moment. If there is no internet connection, application will not work properly.
- Because application pulls data from APIs to show the current state of digital currencies, the states will change regularly. As a result, prices will change over time.

3.4.3. Usability

- The product is expected to be used by who are interested in cryptocurrencies. Users will experience this application with the help of mobile devices.
- Final version of this product should be passed from usability tests. The application will be suitable for users who have beginner level of mobile phone knowledge and has an interest in cryptocurrencies.
- Mobile user interface design principles will be adapted during the development.
- Application should have a plain and simple design for users.

3.4.4. Adaptability

- New stock markets and crypto coins are entering the market every day. Therefore, new stock markets and crypto coins can be added.

3.4.5. Scalability

- Since this product is for mobile devices, multiple users can access this application from their devices.

3.5 Safety Requirements

Giving investment advices is illegal in Turkey unless the advisor is not qualified [30]. Hence, anything shown in the application should not classified as an investment advice.

4. Software Design Document

4.1. Introduction

4.1.1. Purpose

The purpose of this document is to describe “Mobile Assistant for Cryptocurrency Markets” application.

The target audience is people who have interest in economy, stock markets, cryptocurrencies etc.

Our application provide assistance by showing the concurrent values of crypto coins from various digital stock markets, give insights by comparing different cryptocurrencies and visualizing their specific data and help the users by finding the most profitable exchange among cryptocurrencies and stock markets by evaluating distinct stock markets’ prices and transaction fee policies of markets.

Our environment for doing this application is mobile phones that working with Android operating system because every person has a mobile phone and it is practical to follow different stock markets and their momentary values anytime you want with the help of your phone.

This SDD also has activity diagram, UML diagram and block diagram to simplify and visualize the components of the project.

4.1.2. Scope

This document is describing design of the “Mobile Assistant for Cryptocurrency Markets” Document includes all necessary information for the design of this application.

With the interest to cryptocurrencies growing day by day, more people started to ponder about how to make significant profit by trading those virtual currencies using stock market websites which are being used to buy/sell cryptocurrencies, like how people trade foreign exchange using real money. Unlike the people who knows “tricks” and methodologies to profit using those currencies, there are still a lot of people who are interested in trading, but don’t know what to do and which to learn for earning money.

This project’s aim is to assist people who have interest to track down and trade cryptocurrencies. With the help of the stock markets’ API modules, the application can correlate prices and amount of transaction fees after the user selects from multiple stock markets to show users the best chain to follow for earnings. Also, if there isn’t a possible direct exchange (a coin is not supported by market) between two cryptocurrencies in a specific market, the application can suggest a trading path which includes more than one market.

We will use React Native to build the graphical user interface (GUI) of the applications supported by iOS and Android. React Native is a mobile application rendering framework which is written in JavaScript. React Native is based on React, a JavaScript library developed by Facebook to build user interfaces [31].

In the backend side, we will use NodeJS to develop necessary things such as AI algorithms and exchange chain finding. Also, with NodeJS we can pull data from various stock markets using their API modules. NodeJS is a JavaScript run-time environment which is built on Google Chrome's V8 JavaScript engine. NodeJS is used in web programming and web applications [32].

4.1.3. Glossary

TERMS	DEFINITONS
API	API is an interface that utilizes communication between two clients.
Cryptocurrency	Blocks of cryptographic digital information that designed to replace normal currencies.
Stock Market	Stock markets are places where people can buy/sell in a collection of exchanges.
Android	Android is a mobile operating system which is based on a derived Linux kernel.
GUI	The main user interface module consists of graphical icons and indicators.
SDD	Software Design Document
React Native	A framework used in building user interfaces.
JavaScript	An interpreted programming language used mainly in web development.
iOS	Mobile operating system for Apple devices.

Table 2 – Glossary of SDD

4.1.4. Overview

The SDD is divided into subparts with corresponding numbers. Below is their content and explanation.

Section 2 is the "Architectural Design" part that explains the architecture of the application with class diagram, activity diagram and describes use cases.

Section 3 is the "Use Case Realizations" part that contains block diagram of the application and explanation of it.

Section 4 is the "Graphical Interface Design" which describes the design of the application which the user uses.

Section 5 is the "References" that are used in the document.

4.1.5. Motivation

As computer engineer students who have interest in cryptocurrencies, our aim is to develop a mobile application that tracks various markets to obtain values of different crypto coins from different crypto markets. As enthusiasts of cryptocurrency, we want to assist people with the help of this project by showing users best pathway to profit. Also, with the development of

mobile applications becoming more “popular”, a project which includes mobile development can make us enthusiastic about new solutions for mobile development.

4.2. Architecture Design

4.2.1. Class Diagram

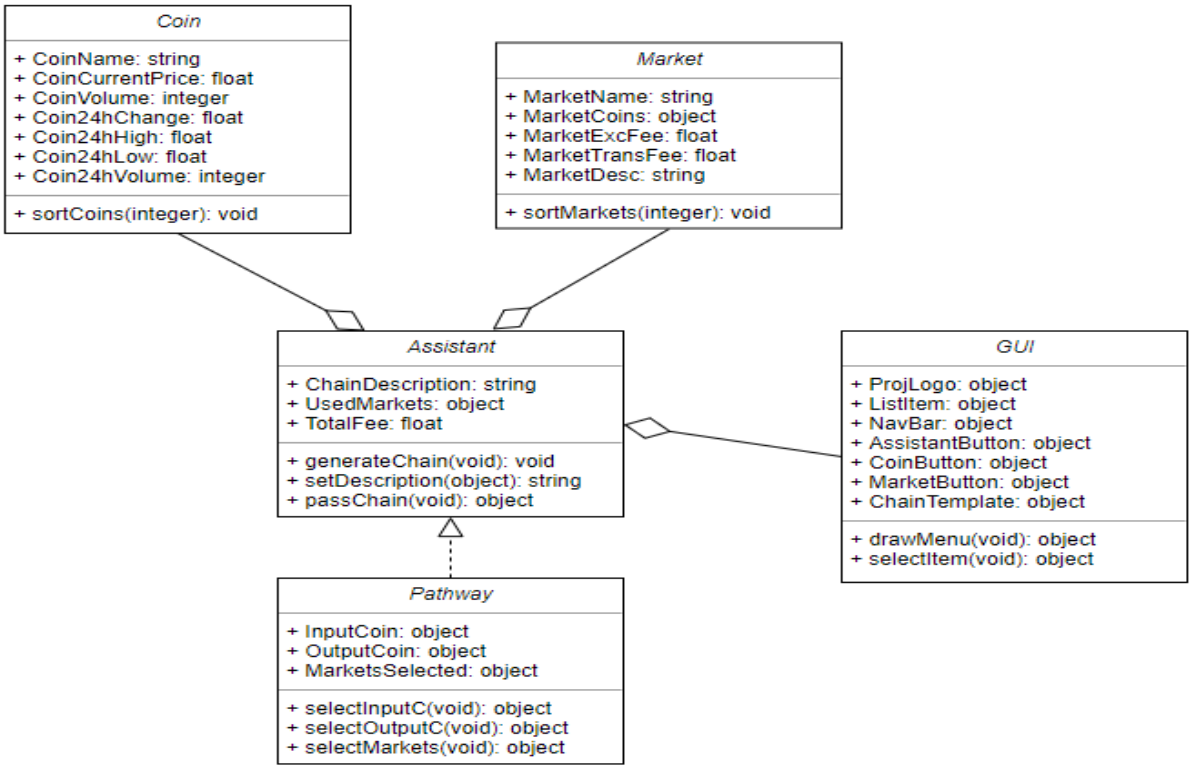

Figure 6 – Class Diagram

Figure 1 shows the class diagram of the Cryptocurrency Assistant application. GUI class represents all objects that a user interacts when using the product, thus it’s defined as to help the user to have total control through the application with ease. Coin class holds the attributes of a coin while Market class has the information of a crypto market, both are extracted within APIs of those markets. Assistant class is to find the most profitable exchange among coins and markets. Pathway class is the class which holds those exchange chains generated by the Assistant class.

4.2.2. Architecture Design of Mobile Assistant

This system is a simple and powerful cryptocurrency portfolio application, in which you can track bitcoin and many altcoin market prices. Users do not have any registration process. It has an easy view to see your cryptocurrency investments on the Android platform and to have more details. Using stock markets’ API modules, we can check latest status of stock markets and currencies. Stock market APIs include core information of the coin such as short name, concurrent value, change percentage, volume, highest and lowest values at the last 24 hours etc. APIs are free to use except if you want to buy/sell coins, there are APIs that has price which provide assistance with buying and selling coins We expect users to encounter a stock market list at first. Users select a market from the market list and according to this, the application

gives a list under the name of the currency list. This list has an up-to-date price list that can be easily seen, and the list can be sorted according to the market value of the currency. It also includes the information section of the market they choose. Features such as current and past pricing, fee prices, volume and exchange info are available. The user has an option under the time-range name to see the performance of the currency in different time periods. In short, the system can help users determine the trend direction and see what the current market situation

4.2.2.1. Start Menu

Summary: This is the system which a user is greeted after starting the application. The user can see various predefined currencies' prices and changes through a day. The user can navigate through Coins, Markets or Assistant menus in the start menu.

Actor: User

Precondition: User is to run the application to see the menu.

Basic Sequence:

1. User shall track predefined coins' information. User should change this coin list from the menu.

2. User shall choose the menu that he/she desired to operate through the start menu by tapping appropriate tabs in the menu.

3. User shall exit the program by pressing "back" button on his/her mobile device.

Exception: None

Post Conditions: None

Priority: Low

4.2.2.2. Market List Menu

Summary: This system is what user must use to see the cryptocurrency markets. User can scroll through a list of markets supported by the application, and user can sort markets by their attributes. If desired, the user can also select a market to learn about the selected markets' policies such as transfer fees and supported coins by the market.

Actor: Participant

Precondition: User must enter Markets menu.

Basic Sequence:

1. User shall see a list of markets which are supported by the application.

2. User shall sort markets by their attributes by tapping filter button, then selecting sort conditions. User can see a market list sorted by appropriate conditions after using filter option.

3. User shall select a market by tapping on it to acquire information related to selected market and coins supported by it.

4. User shall go back by pressing “back” button on his/her mobile device.

Exception: None

Post Conditions: None

Priority: High

4.2.2.3. Coin List Menu

Summary: This system is what user must use to see a list of crypto coins which is pulled from an API which supports most coins. User can scroll through this list and sort them by desired attributes by using filter option. User can also select a coin by tapping on it to see detailed information and supported markets for selected coin.

Actor: Participant

Precondition: User must enter Coins menu.

Priority: High

Basic Sequence:

1. User shall see a list of coins pulled from an API.

2. User shall sort coins by their attributes by tapping filter button, then selecting sort conditions. User can see a list of coins sorted by selected attributes after using the filter option.

3. User shall select a coin by tapping on it to see information such as current price, price history, volume etc. and the markets which support selected coin.

4. User can go back by pressing back button on his/her mobile device.

Exception: None

Post Conditions: None

Priority: High

4.2.2.4. Assistant Menu

Summary: This system is what user must use to acquire pathways which are the most profitable exchange chains.

Actor: Participant

Precondition: None

Basic Sequence:

1. User shall select an input coin or currency to be traded with other coins or currencies.

2. User shall select an output coin or currency to be traded with selected input coin.

3. User shall select one or multiple markets that he/she wants to trade in from a market list. Sorting methods also can be used in this menu.

4. User shall see a list of exchange chains generated by the application.

5. User can go back by pressing back button on his/her mobile device.

Exception: None

Post Conditions: None

Priority: High

4.2.3. Activity Diagram

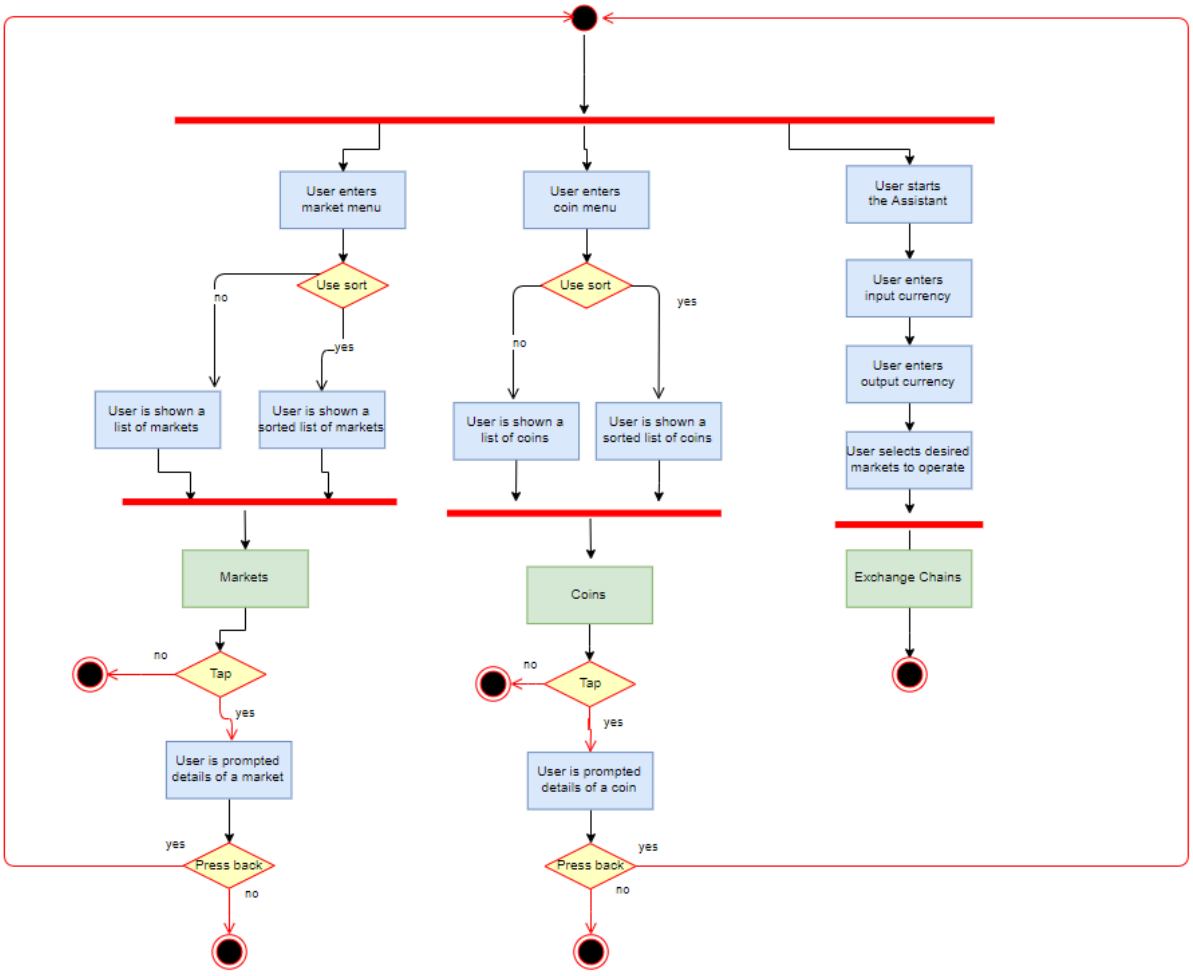

Figure 7 – Activity Diagram

Figure 2 shows the activities can be triggered by the user. After the application is executed, the user shall have three different activities, which are opening markets menu, opening coins menu and opening assistant menu to choose from the start menu.

If the user selects to enter market list, he/she shall be greeted by a list of cryptocurrency markets which is in a database that holds supported markets by the application. If user wants to sort these items, he/she uses filter option with various attributes to sort by, and the list shall be sorted by selections. User can tap on a stock market to select. If so, then user shall see details and tradable coins for the selected market and follow prices of cryptocurrencies in this market.

If the user wants to see coin list, he/she shall be greeted by a list of various cryptocurrencies which is generated from several stock market's API modules to pull data about the cryptocurrencies these markets support. If user wants to sort coins, he/she uses filter option to select attributes. Then, user shall be granted with a list of coins sorted by these attributes. User can tap on a coin to learn more information about it. If so, then user shall be granted with a list of supported markets and price information with price history.

If the user selects to find profitable exchange chains, he/she shall be greeted by an assistant menu. In this menu, user shall select an input and an output currency that he/she wants to exchange and shall select the markets that user wants to operate on. Then, user shall be granted with a list of possible exchange paths which are most profitable in selected attributes.

4.2.4. Work Load

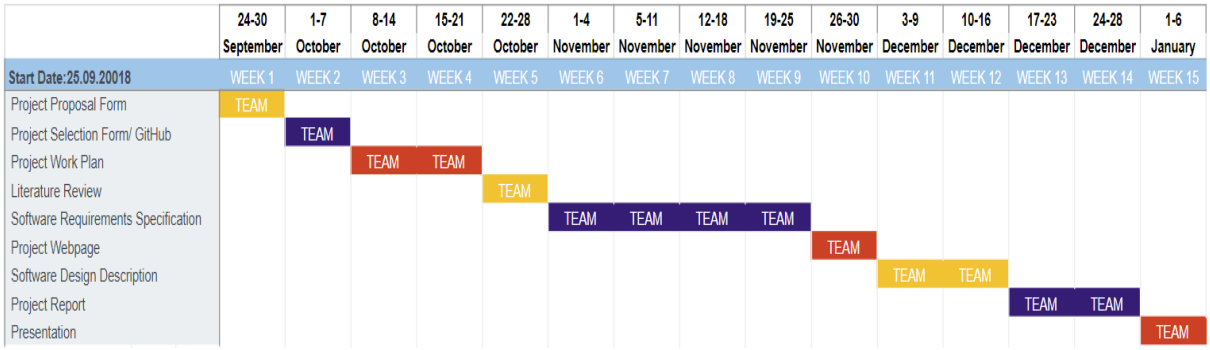

Table 3: Gantt Chart of Work Plan

As seen in the Gantt chart, there is a process in which all members are responsible (Table 1). In this process, the issues related to our project will be investigated. When developing a project, the division of labour and working iteratively are very important to prevent problems in a short time. For best result, we decided to distribute the workload equally to all members of the project.

Work Package	Brief Description	Assignee(s)
Project Proposal Form	To submit a project proposal to get the project from the advisor.	TEAM
Project Selection Form/GitHub	After the advisor accepts the project proposal, a formalization document is given to the project. Similar projects and applications in our project are searched and a GitHub page is created.	TEAM

Project Work Plan	Shows all topics and flow of the project.	TEAM
Literature Review	Identifying, reading and comparing articles related to the project.	TEAM
Software Requirements Specification	Determination, research and documentation of what the project will do.	TEAM
Project Webpage	Designing, writing and publishing a Project Web Page.	TEAM
Software Design Description	Specifying and documenting how to perform the required actions in the Software Requirement Specification.	TEAM
Project Report	Collecting the researches and works that have been prepared so far in a single document.	TEAM
Presentation	Design and preparation of the presentation	TEAM

4.3. Use Case Realizations

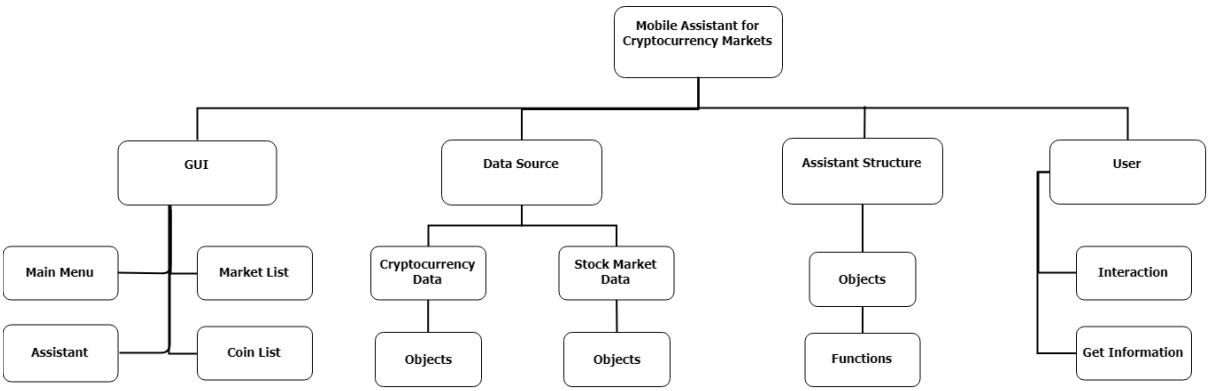

Figure 8 – Block Diagram

4.3.1. Brief Description of Block Diagram

Components of the Mobile Assistant for Cryptocurrency Markets are denoted in the figure 3. There are four main components of the system. These main components have sub-components of their own.

4.3.1.1. GUI

Model of the GUI is necessary for actors to interact within the system's functions. There are four sub-components for GUI which are Main Menu, Market List, Coin List and Assistant. Main menu is the initial page of the system, popular cryptocurrencies such as Bitcoin,

Litecoin will be shown here with their momentary values. In Main Menu, user can select for markets section to see a list of markets, can select for coin list to see a list of coins and user can select assistant. In Market List, user will see a list of stock markets. User can choose a stock market by tapping desired market to see information about market which can be market capitalization, volume, transaction fee and prices of the crypto coins available to that market etc. In Coin List, user will see a list of crypto coins. User can choose a crypto coin by tapping desired coin to see detailed information about that coin which can be market capitalization, price, volume etc. In Assistant, user will see a section that requires input and output coin and user will see a list of markets with corresponding checkboxes to them. After user selects input and output coin, again user checks the desired checkboxes of stock markets and taps “Show” button to see the most profitable Exchange route.

4.3.1.2. Data Source

Data source module consists the data that pulled with the help of APIs. These data can be whether stock markets information or information about specific crypto coin. Also, their submodule objects are the contents of the data which can be market capitalization for example.

4.3.1.3. Assistant Structure

Assistant Structure module consists the functions necessary for calculating the most profitable pathway. It gets input and output coin and desired markets chosen by user and then shows user the best route to profit. Primary algorithmic of the assistant as follows: Program takes input and output coins as inputs. Then, these coins' current prices get pulled from selected markets' API modules. After that, an AI algorithm calculates the most profitable chains by comparing these coins' price information and fee prices of desired markets. Finally, the program outputs the chains which are the most profitable ones (least expensive ones, perhaps) detected by the algorithm.

4.3.1.4. User

User module is the abilities that user can do within the system. User can interact with the system by tapping what he/she desires. After these interactions, user gets the information from the system.

4.4. Graphical User Interface

In this project, we will use React Native to build the graphical user interface (GUI) of the applications supported by iOS and Android.

4.4.1. Overview of Interface

User enters to the system by tapping the application’s icon. After the entrance, main menu will be introduced to the user with two sections. Coins and Markets divided to two for simplicity. Also, participant can select market or coin to see specified details. Lastly, application has an Assistant section which is described below.

4.4.2. Main Menu Design

User can select between coins and markets section to see various coins and markets which is supported by the application. By default, popular coins will be displayed here with their concurrent prices and percentage change. There will be a search engine to find the specific coin or market by entering from keyboard. Also, in the search engine, if no letter is entered, all coins and markets will be displayed. User can select coin from there and add it to the coin list on the main menu if he/she wants. Example images are below.

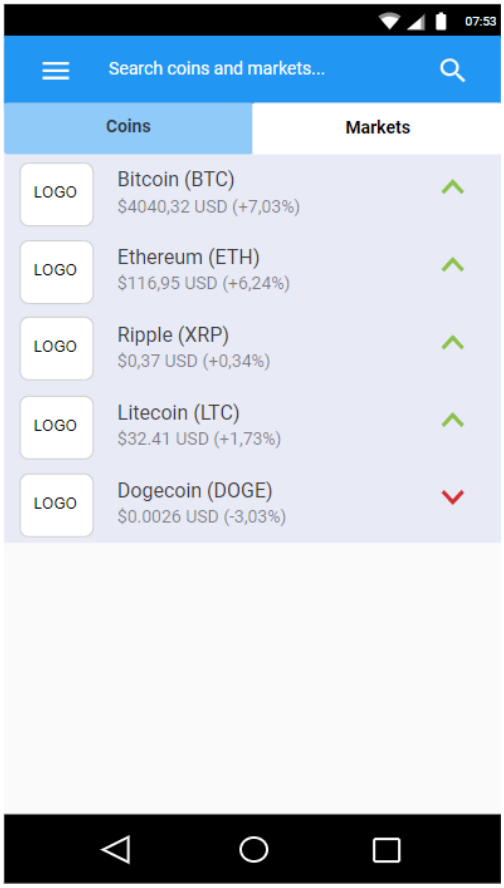

Figure 9 – Main Menu Screen Image 1

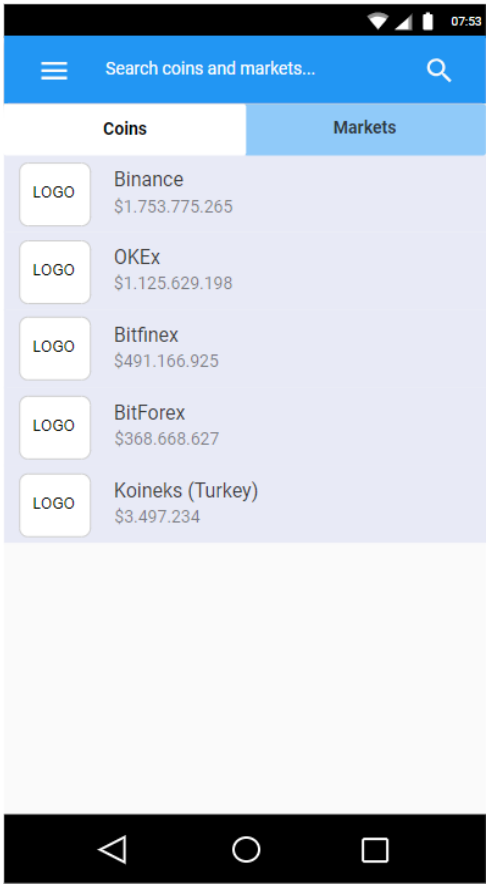

Figure 10 – Main Menu Screen Image 2

If specific coin is selected by user, its detailed information will be displayed to the user which are coin's current price, volume, lowest and highest values within the last 24 hours. There is an option which user can choose any of the given time interval to see its value at that time. Lastly, markets that supporting that coin will be displayed there. Example image is below.

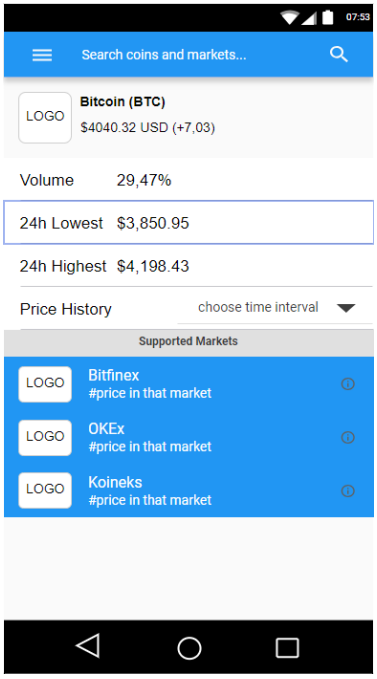

Figure 11 – Coin Detailed Information Image

4.4.3. Assistant Design

If user entered to the Assistant, application ask participant to enter input and output currency and a list of markets will be shown which are supported by the system with the corresponding checkboxes to them. After user enters input and output currency, user selects desired markets by checking the checkboxes. After the selections, participant taps the “Find Possible Chains” button to see possible paths to profit. Example images are below.

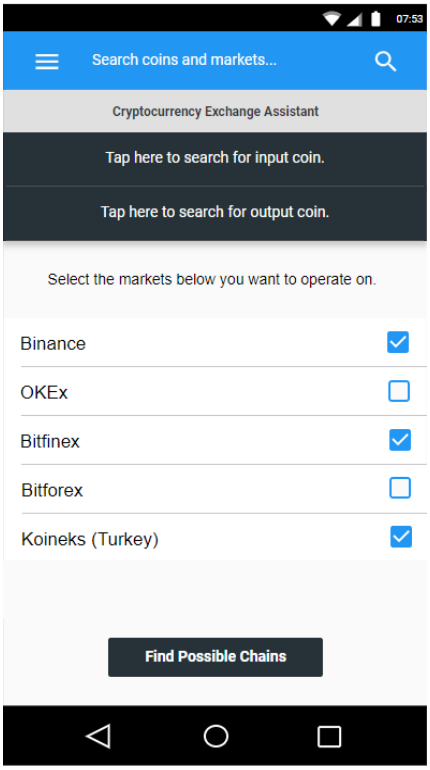

Figure 12 – Assistant Screen Image

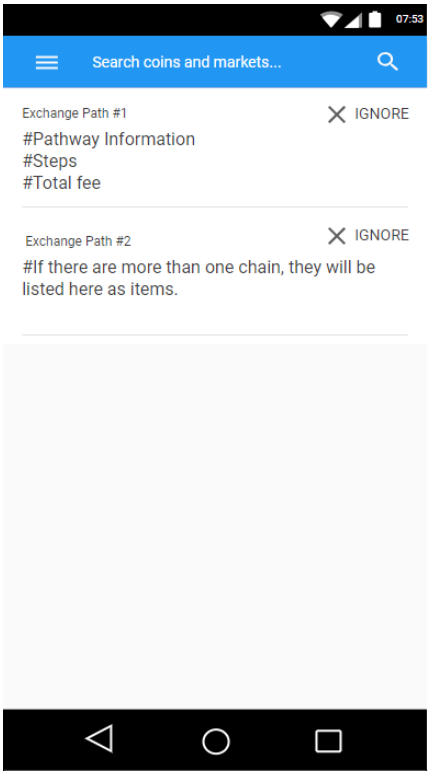

Figure 13 – Assistant Page After Calculations Image

5. Conclusions

This report contents detailed information about Mobile Assistant for Cryptocurrency Markets. In this project, our main goal is to help people who have interest in cryptocurrencies with mobile application by tracking different crypto coins from various stock markets. Our environment is the Android and we have planned to use React Native as a front-end and NodeJS as a back-end development tools.

To develop this project, we researched about previous works, we analysed different documents to have information about the concept. After our research finished, we have defined the requirements of the project with our supervisor. With these requirements, we prepared Software Requirement Specification(SRS) document. In terms of determine the design of the project, we prepared a Software Design Document(SDD) for explanation.

Our study shows that there are not many applications that has a functionality like our project. Our “Assistant” gives new aspect to similar applications. In the future, we will implement necessary requirements to the application according to our SRS and SDD documents. We will revise our documents regularly while developing the project, so these documents are not final version.

Acknowledgement

We would like to express our appreciation to our advisor Dr. Faris Serdar Taşel because of his guidance and assistance. We improved with the project thanks to his valuable advices.

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