AN ONLINE WEB STREAMING SERVICE FOR BITCOIN EXCHANGES

Project Proposal

Information Technology Capstone Project

COMP5703

Group Members

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ABSTRACT

The motivation behind this proposal is to fill an information gap within the financial sector in terms of cryptocurrency. Since Bitcoin was first introduced in 2009, cryptocurrency has become increasingly popular, leading to a surge in new cryptocurrencies and investment opportunities. In order to invest, a culmination of financial data and market analysis is needed in order to make informed decisions, much like stocks and bonds.

Unfortunately, the quality and quantity of available visualisations of financial market data for cryptocurrency exchanges differs depending on the cryptocurrency exchange used. Third party platforms compatible with multiple cryptocurrency exchanges are available but limited when it comes to the comparison of basic financial market data between exchanges, such as price and volume. This causes information to be in multiple places and leaves some conversion and analysis up to the user.

The project proposed is aimed at creating a Web Application allowing the comparison of cryptocurrencies market data (price, volume, and liquidity of order books) for the BTC/USD pair from two different exchanges by using different visualisation techniques such as candle and market depth charts.

In order to accomplish the objective, the project uses a hybrid agile methodology for the software development process based on incremental development. As cryptocurrency is fast paced and constantly changing, this methodology allows the scope to quickly adapt and seize opportunities that may arise during the project, but also allows the team to stay flexible and add as many features as possible given the limited time frame available.

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1. INTRODUCTION

The cryptocurrency market has increased by 1,204% in 2017 alone, with a total market cap of $230.9 billion (Bovaird, 2017). Buying and selling cryptocurrencies has become an extremely popular activity. One way to acquire or dispose of cryptocurrencies is by using a cryptocurrency exchange. Cryptocurrency exchanges facilitate buying and selling cryptocurrencies in a similar fashion that regular stock exchanges do.

Unlike the stock market, the same cryptocurrency can be available on multiple exchanges which spreads the information, orders, and liquidity across multiple exchanges.

Also, the quality and quantity of available visualisations of financial market data for cryptocurrency exchanges differs depending on the cryptocurrency exchange used. Third party platforms compatible with multiple cryptocurrency exchanges are available but limited when it comes to the comparison of basic financial market data between exchanges, such as price and volume.

Filling this information gap by creating an application allowing the centralisation of this information historically or in real-time would allow for a better understanding and overview of the crypto market. This application would be able to fulfil educational purposes or allow for more informed decisions when trading cryptocurrencies.

2. RELATED LITERATURE

2.1 Literature Review

Cryptocurrency is a digital currency that uses blockchain technology in order to authenticate and record transactions. Since Bitcoin was first introduced in 2009, cryptocurrency has become increasingly popular, introducing a great number of cryptocurrencies to the market such as Ethereum, Ripple, and Dash (Furlonger, Valdes, & Kandaswamy, 2017).

Much like stocks and bonds, cryptocurrency is traded on exchanges and requires a culmination of financial data and market analysis in order to make informed decisions. Online platforms, like Coinigy, are providing some basic visualisation charts for traders/users to acquire real-time or historical transaction data (e.g. price, volume, liquidity, etc.) among different cryptocurrencies from different exchanges ("Coinigy - Professional Bitcoin & Cryptocurrency Trading Platform", 2018). For example, a simple line chart can be used to display the prices for a given period of time or a candlestick chart, offering the high and low of the buy and sell orders in specified intervals, to acquire more information about price over time ("CoinDesk - Understanding Bitcoin Price Charts: A Primer", 2014). In addition, platforms like CryptoCompare.com provide a visual dashboard for traders to compare cryptocurrency with actual currency like the US Dollar ("CryptoCompare - Live Cryptocurrency Prices, Trades, Volumes, Forums, Wallets, Mining Equipment and Reviews", 2018).

There are limitations, especially in visualisation, when it comes to mainstream trading platforms. In order to design and provide efficient and effective visualisation solutions for users, two general principles should be followed:

1. Choose the right data
2. Choose the right visualisation

Firstly, time-based transaction data often has multi-dimensional attributes (Xie et al., 2014). A three-level model: the goal, the questions, and the measures, is defined for the designer to understand the data (Janes, Sillitti, & Succi, 2013). Secondly, aesthetics like colour coding, layout, and chart type should be selected carefully to avoid conveying information in a confusing manner or creating cognitive overload.

In conclusion, for the visualisation of information to be useful, it has to contain/display data related/according to the business goals. The development of such visualisation requires comprehensive understanding as well.

3. PROJECT PROBLEMS

3.1 Project Aims & Objectives

To develop a web application:

- Utilising visualisation techniques, such as charts, to easily display and compare cryptocurrency market data including, but not limited to: transactional volume and price between different cryptocurrency exchanges for the BTC/USD trading pair.
- Modular and flexible to easily allow the addition of extra cryptocurrency pairs or exchanges.
- Providing a pleasing user experience with ease of use, and a clean, organised layout.

3.2 Project Problems

- Quality and quantity of available visualisations of financial market data of cryptocurrency exchanges differs and is specific to the cryptocurrency exchange used.
- Third-party platforms are available but focused on trading and limited to the comparison of basic financial market data between exchanges such as price and volume.
- Users would like to compare market data of multiple exchanges on a single platform instead of having to use multiple websites at the same time.

3.3 Project Scope

The team will develop a web application using visualisation techniques to display and/or compare real-time or historical financial market data including, but not limited to: price data of two cryptocurrency exchanges for the BTC/USD trading pair.

The scope of this project only includes the development of the said application.

The deployment of the application on the client's infrastructure is out of scope.

Any analysis of the data or visualisations provided by the application is out of scope.

4. METHODOLOGIES

4.1 Management Approach

The project is conducted by a professional team with diverse expertise in Bitcoin, web application development, and data analytics. The team has implemented a comprehensive set of project management methodology, processes, and procedures. For example: the project tasks are assigned and monitored through an online project management tool; a secure environment has been set up for team coding, knowledge management, and communication; and a weekly meeting is scheduled as a quality assurance mechanism to ensure the project is on track towards success. More details on project supporting resources can be found in the Resources section (Section 5) of this proposal.

4.2 Development Methods

Based on the background of the project and the client requirements, the product requires a flexible and iterative development approach in order to achieve all of the aims and objectives.

Therefore, the project will follow a hybrid System Delivery Life Cycle (SDLC) methodology in terms of both the agile and waterfall model (Figure 1).

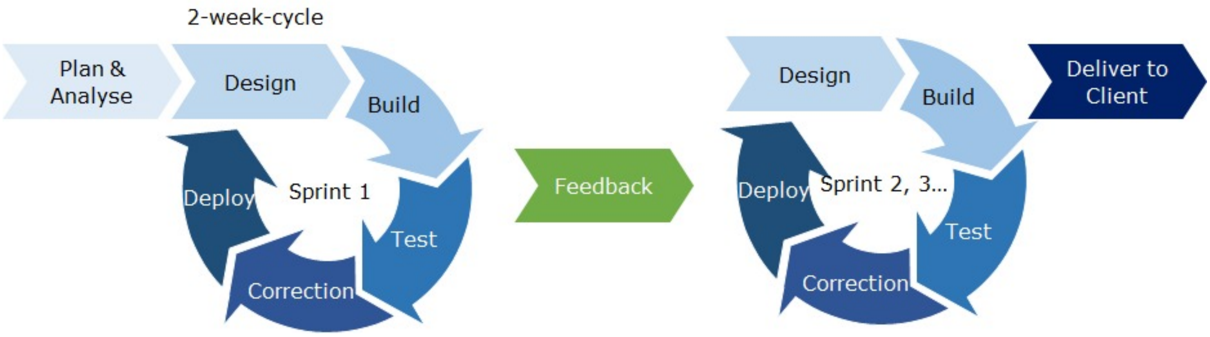


Figure 1 - Created by COMP5703 CP22 Group 5

The initial phase of the project is the planning and analysing phase, which mainly focuses on defining the project scope and product features, as well as determining technology stacks. The second phase is a set of spiral cycles (or sprints). Each sprint lasts for approximately 2 weeks and contains following stages: design, build, test, correction, and deploy. There will also be a short feedback phase at the end of each sprint in order to review whether it meets the project goals and client requirements. The final phase will be delivering the final product to client after conducting end-of-lifecycle testing and comprehensive quality assurance checks.

4.3 Data Collection

The application will collect financial market data from cryptocurrency exchanges using their APIs and store the data in the application's database. Effective testing and examinations will be conducted by the project team and the data specialist will ensure data integrity and quality.

4.4 Data Analysis

Not applicable for this project. Any data analysis is out of scope as mentioned in the project scope statement.

4.5 Deployment

The client is required to have a GitHub account and will be granted access to the application's GitHub repository.

The final release of the web application will be provided as a zip file, downloadable from the release page on the application's GitHub repository. Subsequent updates will be added to the release page and downloadable in the same manner.

The application is a regular Nodejs-MongoDB application. The client is responsible for deploying and configuring it on their own infrastructure.

Bugs shall be reported by email or using the “Report Issue” function on the application’s GitHub repository. A new release containing the bug fix will then be created and made available on the GitHub release page of the application. The client is responsible for downloading this release and re-deploying it on their infrastructure.

4.6 Testing

The testing process and methodology of this project will follow the “whole team” strategy of agile, in which each member of the team will be involved in the testing phase to ensure the product’s high quality. Therefore, the testing mechanism of this project can be mainly divided into the following parts:

1) Test-Immediately After Approach in every sprint.
2) End of Lifecycle Testing before delivery to the client.

During the first part, as a small team, the role of coder and tester will be merged so that a cross-test method will be applied to review and fix the defects efficiently and effectively.

For the second part, before the product is ready to deliver, an independent test will be conducted by the whole team. A comprehensive checklist with related supporting tools will be designed and applied during this part for quality assurance and client acceptance.

4.7 Quality Assurance

Quality assurance is the responsibility of a quality assurance subgroup within the team. These members will ensure the web application meets the project goals and requirements as well as guarantee the general quality of the software delivered.

5. RESOURCES

In order to develop the web application, a detailed list of the resources is provided within this section.

5.1 Hardware & Software

Hardware

The product is a web application that is accessible through an internet browser, preferably Google Chrome. The application would need to be running on a server that can handle large data. Therefore, the server should have 1.6GHz CPU with 1.75 Gb RAM. It should have least 40 Gb of free space for the data.

Front End

React: The web application will be using the React library to build the user interfaces for the web application. The framework JSX, which combines both HTML and JavaScript, makes it easier to develop the application. It also improves the performance of the application and makes it easier to perform unit testing and integration testing.

Bootstrap: The web application will be using the Bootstrap CSS framework. Using an established and proven CSS framework will allow for faster development of the user interface while maintaining high-quality standards.

D3.js: The application will use the D3 charting library to display and draw chars for the application. D3 can manipulate parts of the DOM and is very flexible with existing web technologies. By using SVG, D3 has no limitations or restrictions, thus, can be used to create unique charts with changes specific to the web application.

Back End

NodeJS: The server side of the web application will be created using NodeJS v8. NodeJS runs on the traditional JavaScript engine and is able to operate extremely fast. NodeJS works mainly on a non-blocking I/O model. This makes the framework ideal for real time web applications that utilise large amounts of data. It also works with other web technologies and utilises less memory compared to other server engines.

ExpressJS: The application will use the ExpressJS framework for the server side. ExpressJS makes development in NodeJS easy and efficient. The framework makes use of middleware to respond to various HTTP requests and makes it easier to connect with the MongoDB database.

MongoDB: MongoDB is a NoSQL database. It does not use complex joins and makes the structure of the document and object clear. MongoDB also uses Document Oriented Storage whereby data of the application can be stored in JSON format. It is more scalable and can handle large data efficiently, thereby providing superior performance to the application.

5.2 Materials

Project Management Tools

Slack: Slack is the main tool used for communication and knowledge sharing between team members. Slack improves collaboration between team members by using various channels to organise conversations according to predefined topics. Team members can share files, conversations, and documents within slack channels and add additional comments under these files. Additionally, Slack provides integration with various other applications and makes it a single platform for all the project's needs.

TeamGantt: TeamGantt is a project planning tool that uses a Gantt chart to track the progress of the project. The team uses TeamGantt to plan and manage the project effectively. Each member can view and update their own progress for their assigned tasks.

GitHub: GitHub is version control system used to store code and improve collaboration between team members. Each team member would have his own repository where he can work and update his code and share it with other team members.

SharePoint: All the reports and documentation will be stored in Microsoft SharePoint as a backup. SharePoint allows team members to collaborate on the documentation and make live changes to the documentation.

Other Tools

WebSocket API- The web application uses WebSocket API instead of REST API in order to enhance the efficiency of communication between the client and the server. WebSocket allows data to be sent from the client side to the server side any time by using server-push. Hence, it allows the application to constantly update the webpage in real-time. Additionally, the data frame of the WebSocket is organised and can send data more efficiently.

5.3 Roles & Responsibilities

Karim Santallo

Team Lead, Web Developer, Quality Assurance

- Keeps the team on track to deliver a quality product on time.
- Responsible for the implementation and management of the agile methodology.

- Maintains the product backlogs and planning of sprints.
- Schedules, organises and facilitates team meetings.
- Front-End/Back-End functions design, implementation, and testing.
- Quality assurance of software and report deliverables.

Jiaqing Li

Web developer / Data specialist, Quality Assurance

- Assist Team Lead with management duties and responsibilities.
- Responsible for design and implementation of database functions.
- Front-End/Back-End functions design, implementation, and testing.
- Quality assurance of software and report deliverables.

Sreejith Warrier

Lead Back-End Developer

- Responsible for major back-end functions design, implementation, and testing.
- Provides counsel on technical back-end design decisions.
- Assist with front-end development when necessary.

Yangkai Hong

Lead Front-End Developer

- Responsible for major front-end functions design, implementation, and testing.
- Provides counsel on technical front-end design decisions.
- Assist with back-end development when necessary.

6. Expected Outcomes

6.1 Project Deliverables

1) Web Application

A Web Application allowing the comparison of cryptocurrencies market data (price, volume, and liquidity of order books) for the BTC/USD pair from two different exchanges by using different visualisation techniques such as candle and market depth charts.

2) Web Application Demonstration

A demonstration of the web application and its functionalities will be provided in week thirteen to the clients.

3) Progress Report

A progress report will be provided in week nine, highlighting the obstacles the team encountered as well as any deviation to the projected timeline.

4) Final Report

A final report will be provided at the end of the project. More details will be provided in a later stage of the project.

6.2 Implications

This web application could be used as an educational tool to help understand how trading works on cryptocurrency exchanges, as well as to understand the differences and similarities between cryptocurrency and traditional stock exchanges. Additional projects could also make use of this tool to analyse data from these cryptocurrency exchanges and try to identify patterns and trends to help create price prediction models. Finally, this application could also be used as a business intelligence tool for trading decisions.

7. TIMELINE

As discussed in Section 4, the project follows an "agile" methodology based on incremental development. Each iteration, called a "sprint" here, aims at delivering a product that will be refined with each new iteration based on feedback from the client.

This project will consist of four sprints. Each sprint has a two-week duration.

A list and description of the milestones, sprints, and Gantt chart have been provided below.

7.1 Milestones

Milestone	Description	Planned Date
Project Start-Up Session Completed – Initial Product Backlog Created	The team has been formed and understands the objectives of the project. High-level design decisions have been completed. Initial set of features to start development iterations	29/08/2018
Project Proposal Submission and Approval	The project proposal submitted has been approved.	Week 5 (27/10/2018 – 02/11/2018)

Start of Development Iterations	See Section 7.2 for more details.	29/08/2018
Progress Report	Progress report on obstacles encountered, deviation to the planned timeline, etc.	28/09/2018 by 5pm
End of Development Iterations	See Section 7.2 for more details.	22/10/2018
Web Application Demonstration to Clients	Presentation to clients of the final release of the web application.	Week 13 (22/10/2018 - 26/10/2018)
Final Release to Clients Submitted	The files for the final release of the web application have been transferred to the clients. Project can be closed.	26/10/2018 by 5pm
Final Report	More details will be provided in a later stage of the project.	26/10/2018 by 5pm

7.2 Sprints

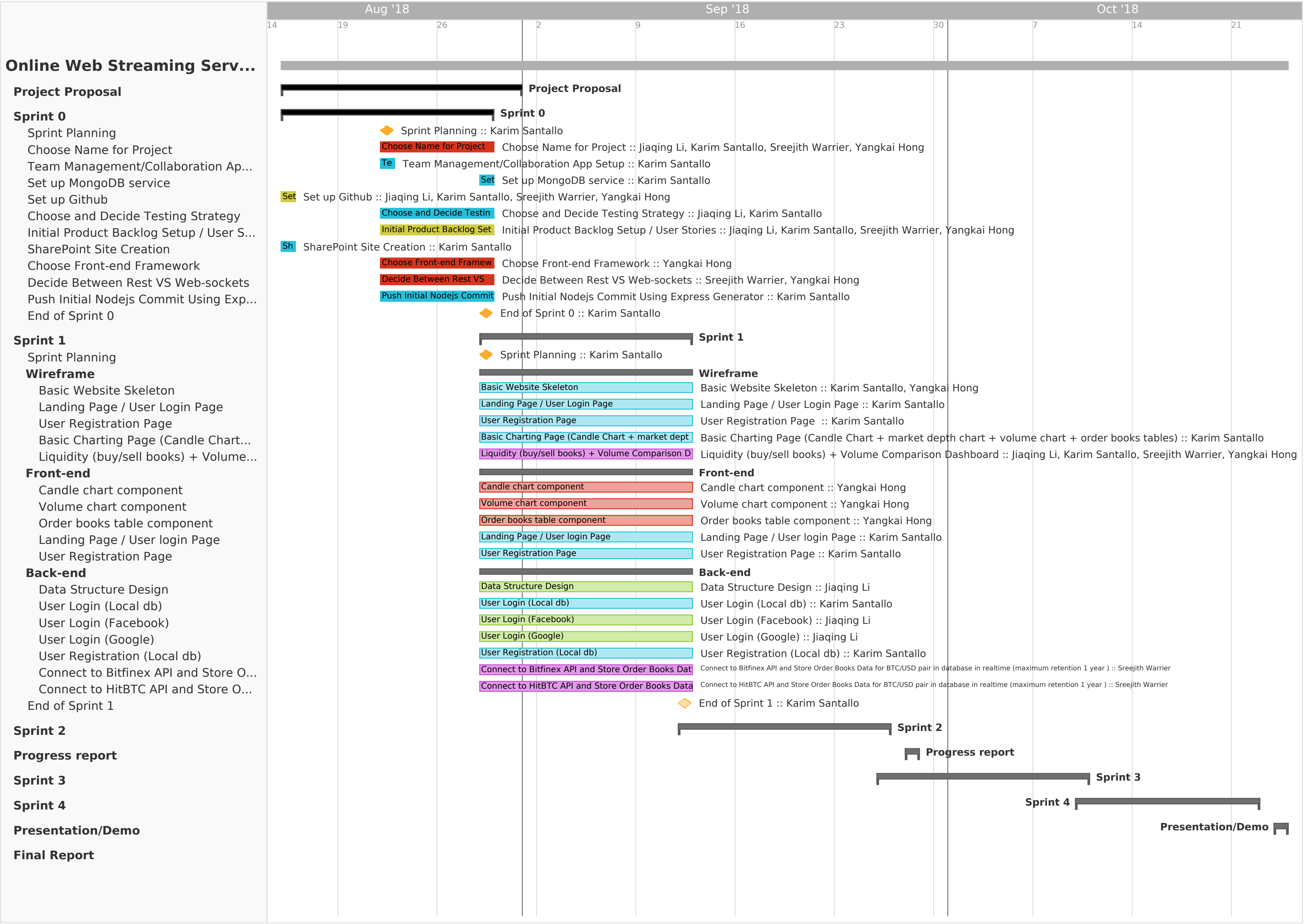
Iteration	Description	Start Date	End Date
Sprint 1	Website skeleton creation and implementation. Basic functionalities implementation.	29/08/2018	12/09/2018
Sprint 2	Basic functionalities implementation. Front-end interface enhancements.	12/09/2018	26/09/2018

Sprint 3	Optional features implementation.	26/09/2018	10/10/2018
Sprint 4	Web application finalisation.	10/10/2018	22/10/2018

7.3 Gantt Chart

A Gantt chart, exported from our management tool TeamGantt, is provided below. The methodology chosen recommends not to plan the exact tasks of each sprint too far in advance. As a consequence, only sprint 1 is detailed below.

Sprint 0 in the chart includes the start-up sessions mentioned in the milestones table.



Aug '18
Sep '18
Oct '18
14
19
26
2
9
16
23
30
7
14
21
Online Web Streaming Serv...
Project Proposal
Sprint 0
Sprint Planning
Choose Name for Project
Team Management/Collaboration Ap...
Set up MongoDB service
Set up Github
Choose and Decide Testing Strategy
Initial Product Backlog Setup / User S...
SharePoint Site Creation
Choose Front-end Framework
Decide Between Rest VS Web-sockets
Push Initial Nodejs Commit Using Exp...
End of Sprint 0
Sprint 1
Sprint Planning
Wireframe
Basic Website Skeleton
Landing Page / User Login Page
User Registration Page
Basic Charting Page (Candle Chart...
Liquidity (buy/sell books) + Volume...
Front-end
Candle chart component
Volume chart component
Order books table component
Landing Page / User login Page
User Registration Page
Back-end
Data Structure Design
User Login (Local db)
User Login (Facebook)
User Login (Google)
User Registration (Local db)
Connect to Bitfinex API and Store O...
Connect to HitBTC API and Store O...
End of Sprint 1
Sprint 2
Progress report
Sprint 3
Sprint 4
Presentation/Demo
Final Report
Project Proposal
Sprint 0
Sprint Planning :: Karim Santallo
Choose Name for Project
Choose Name for Project :: Jiaqing Li, Karim Santallo, Sreejith Warrier, Yangkai Hong
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Team Management/Collaboration App Setup :: Karim Santallo
Set
Set up MongoDB service :: Karim Santallo
Set
Set up Github :: Jiaqing Li, Karim Santallo, Sreejith Warrier, Yangkai Hong
Choose and Decide Testin
Choose and Decide Testing Strategy :: Jiaqing Li, Karim Santallo
Initial Product Backlog Set
Initial Product Backlog Setup / User Stories :: Jiaqing Li, Karim Santallo, Sreejith Warrier, Yangkai Hong
Sh
SharePoint Site Creation :: Karim Santallo
Choose Front-end Framew
Choose Front-end Framework :: Yangkai Hong
Decide Between Rest VS
Decide Between Rest VS Web-sockets :: Sreejith Warrier, Yangkai Hong
Push Initial Nodejs Commit
Push Initial Nodejs Commit Using Express Generator :: Karim Santallo
End of Sprint 0 :: Karim Santallo
Sprint 1
Sprint Planning :: Karim Santallo
Wireframe
Basic Website Skeleton
Basic Website Skeleton :: Karim Santallo, Yangkai Hong
Landing Page / User Login Page
Landing Page / User Login Page :: Karim Santallo
User Registration Page
User Registration Page :: Karim Santallo
Basic Charting Page (Candle Chart + market dept
Basic Charting Page (Candle Chart + market depth chart + volume chart + order books tables) :: Karim Santallo
Liquidity (buy/sell books) + Volume Comparison D
Liquidity (buy/sell books) + Volume Comparison Dashboard :: Jiaqing Li, Karim Santallo, Sreejith Warrier, Yangkai Hong
Front-end
Candle chart component
Candle chart component :: Yangkai Hong
Volume chart component
Volume chart component :: Yangkai Hong
Order books table component
Order books table component :: Yangkai Hong
Landing Page / User login Page
Landing Page / User login Page :: Karim Santallo
User Registration Page
User Registration Page :: Karim Santallo
Back-end
Data Structure Design
Data Structure Design :: Jiaqing Li
User Login (Local db)
User Login (Local db) :: Karim Santallo
User Login (Facebook)
User Login (Facebook) :: Jiaqing Li
User Login (Google)
User Login (Google) :: Jiaqing Li
User Registration (Local db)
User Registration (Local db) :: Karim Santallo
Connect to Bitfinex API and Store Order Books Dat
Connect to Bitfinex API and Store Order Books Data for BTC/USD pair in database in realtime (maximum retention 1 year) :: Sreejith Warrier
Connect to HitBTC API and Store Order Books Data
Connect to HitBTC API and Store Order Books Data for BTC/USD pair in database in realtime (maximum retention 1 year) :: Sreejith Warrier
End of Sprint 1 :: Karim Santallo
Sprint 2
Progress report
Sprint 3
Sprint 4
Presentation/Demo

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